Surgery, Gynecology and Obstetrics

An International Journal
Published Monthly

EDITORIAL STAFF

FOR AMERICA

John B. Murphy, M. D.
E. Wyllys Andrews, M. D. J. Clarence Webster, M. D.

L. L. McArthur, M. D.	E. C. Dudley, M. D.	Frederic A. Besley, M. D.
A. J. Ochsner, M. D.	C. S. Bacon, M. D.	William R. Cubbins, M. D.
John Ridlon, M. D.	Cecil v. Bachellé, M. D.	John C. Hollister, M. D.
Thomas J. Watkins, M. D.	Carl Beck, M. D.	Rudolph W. Holmes, M. D.

FOR THE BRITISH EMPIRE

A. W. Mayo-Robson, C. V. O., D. Sc., F. R. C. S., London

B. G. A. Moynihan, M. S., F. R. C. S., Leeds	Thomas W. Eden, M. D., F. R. C. S., London
Harold J. Stiles, M. B., F. R. C. S., Edinburgh	Henry Jellett, M. D., F. R. C. P. I., Dublin

James Rutherford Morison, M. B., F. R. C. S., Newcastle-on-Tyne

---

Franklin H. Martin, M. D., Managing Editor
Allen B. Kanavel, M. D., Associate Editor

Volume XIX
July-December, 1914

PUBLISHED BY
THE SURGICAL PUBLISHING COMPANY OF CHICAGO
30 NORTH MICHIGAN AVENUE, CHICAGO
1914

COLLABORATORS

CHICAGO

Ex-Officio { CHARLES P. CALDWELL, M. D., President Chicago Medical Society
M. L. HARRIS, M. D., President Chicago Surgical Society
FRANK W. LYNCH, M. D., President Chicago Gynecological Society

W. H. Allport, M. D.
Frank T. Andrews, M. D.
James Burry, M. D.
Henry T. Bylord, M. D.
Frank Cary, M. D.
Charles Davison, M. D.
Joseph B. DeLee, M. D.
E. J. Doering, M. D.
Frank B. Earle, M. D.
Jacob Frank, M. D.
Albert Goldspohn, M. D.
David W. Graham, M. D.
A. E. Halstead, M. D.
M. L. Harris, M. D.
Wm. M. Harsha, M. D.
J. C. Hoag, M. D.
Gustav Kolischer, M. D.
Henry F. Lewis, M. D.
Andrew McDermid, M. D.
John E. Owens, M. D.
C. E. Paddock, M. D.
S. C. Plummer, M. D.
John L. Porter, M. D.
C. B. Reed, M. D.
H. M. Richter, M. D.
E. C. Riebel, M. D.
Wm. E. Schroeder, M. D.
E. J. Senn, M. D.
D. A. K. Steele, M. D.
Weller Van Hook, M. D.
Bertha Van Hoosen, M. D.
Lucy Waite, M. D.

NEW YORK

J. D. Emmet, M. D. Austin Flint, Jr., M. D.

BOSTON

Walter L. Burrage, M. D. Edward Reynolds, M. D.

PHILADELPHIA

E. E. Montgomery, M. D. John B. Deaver, M. D.
Edward P. Davis, M. D.

BALTIMORE

Howard A. Kelly, M. D. J. C. Bloodgood, M. D.
J. Whitridge Williams, M. D.

WASHINGTON

Henry D. Fry, M. D. J. Wesley Bovée, M. D.

ROCHESTER, MINN.

William J. Mayo, M. D. Charles H. Mayo, M. D.

ST. LOUIS

N. B. Carson, M. D. Walter B. Dorsett, M. D.
M. G. Seelig, M. D.

KANSAS CITY

A. A. Cordier, M. D. J. D. Griffith, M. D.

LOUISVILLE

Lewis S. McMurtry, M. D. Ap. Morgan Vance, M. D.

DENVER

W. W. Grant, M. D.

COPYRIGHT BY
THE SURGICAL PUBLISHING COMPANY
OF CHICAGO
1914

CONTRIBUTORS TO VOLUME XIX

ALLAN, R. M. 241
ALLISON, NATHANIEL. 568
ARKIN, AARON. 419
ARMSTRONG, GEORGE E. 342, 699
BALFOUR, DONALD C. 528
BARRIE, GEORGE. 42
BARNES, WALTER S. 541
BARNETT, CHARLES E. 753
BECK, JOSEPH C. 98
BEHAN, RICHARD J. 199
BERKOWITZ, SAMUEL. 797
BIRDSALL, J. C. 390
BLAIR, EDWARD G. 718
BLAIR, V. P. 436
BRATRUD, T. 30
BRYAN, W. A. 113
BROOKS, BARNEY. 568
BUCK, MICHAEL J. 487
BUERGER, LEO. 536, 582
BUNTS, FRANK E. 791
BURNHAM, A. C. 468
BUTT, ARTHUR PARKER. 419
CARREL, ALEXIS. 226
CASE, JAMES T. 592
CHETWOOD, CHARLES H. 36, 657
CONNELL, F. GREGORY. 742
COOPERNAIL, G. P. 421
CORBETT, J. FRANK. 5
COTTON, FREDERIC J. 780
CUNNINGHAM, JOHN H. 693
CURTIS, ARTHUR H. 25
DACHTLER, H. W. 781
DAVIS, BENJAMIN F. 490
DAVIS, EDWARD P. 251
DAVIS, GEORGE G. 691
DOEDERLEIN, THEODORE J. 165, 255
DOWMAN, CHARLES E., JR. 415
EISELSBERG, A. VON. 555
ELSE, J. EARL. 482
FAY, OLIVER J. 174
FIGUEROA, SIEGFRIED. 674
FOSTER, GEORGE S. 248
FOWLER, RUSSELL S. 667
FRANK, ROBERT T. 618
FREEMAN, LEONARD. 110
FREIBERG, ALBERT H. 116, 191
FULLERTON, WILLIAM D. 711
GANT, SAMUEL G. 704
GARDNER, LEROY U. 772
GELLHORN, GEORGE. 492
GEORGE, ARIAL W. 395
GERBER, ISAAC. 395
GOODMAN, CHARLES. 797
GOODWIN, H. T. 779
GRAHAM, EVARTS A. 360
GRIFFITHS, EVAN H. M. 424
HAAS, S. L. 604
HAGNER, FRANCIS R. 677, 792
HANAN, JAMES T. 117
HAUBOLD, H. A. 669
HEALD, CLARENCE L. 794
HENDERSON, YANDELL. 386
HENZE, CARL WILLIAM. 10
HEYD, CHARLES GORDON. 91, 224
HILLMAN, O. S. 42
HOGE, A. F. 799
HOOKER, RANSOM S. 235
HUPP, FRANK LEMOYNE. 671
HYMAN, A. 407
IVY, ROBERT H. 390
JACHES, LEOPOLD. 407
JACKSON, REGINALD H. 232
JELLETT, HENRY. 346
JONES, HUGH E. 747
JONES, ROBERT. 427
JORDAN, ALFRED C. 384
KELLY, HOWARD A. 601
KEYES, A. BELCHAM. 364, 423
KRETSCHMER, HERMAN L. 766
KROTOSZYNER, MARTIN. 522
KÜMMELL, H. 163, 334
LAW, ARTHUR AYER. 229
LEWIS, ELIZABETH G. 757
LEWIS, ROBERT M. 601
LIPPMAN, C. W. 724
LOCKWOOD, CHARLES D. 462
MACAUSLAND, W. RUSSELL. 404
MACDONALD, T. L. 215
MACKLEM, GLEN EDRIE. 156
MADILL, D. G. 241
MARSHALL, VICTOR F. 114
MAYER, LEO. 10
MAYO, CHARLES H. 351
MAYO, WILLIAM J. 683
MCCARTY, FRANKLIN B. 509
MCGLANNAN, ALEXIUS. 475
MCGLINN, JOHN A. 515
MCKENTY, F. E. 141
MERRILL, WILLIAM JACKSON. 67
MOODY, ADELBERT M. 766
MOORE, J. E. 5
MORGAN, H. J. 781
MOSCHCOWITZ, ALEXIS V. 520
MULLALLY, EMMET J. 699
NAGEL, W. 82
NEUHOF, HAROLD. 193
NOVAK, EMIL. 412
OECHSNER, JOHN F. 531
OPPENHEIMER, EDGAR D. 103
PALMER, E. PAYNE. 664
PERCY, JAMES F. 452
PETTIT, J. A. 704
PFAHLER, GEORGE E. 658, 783
PHEMISTER, D. B. 303
PHILLIPS, CHARLES E. 729
PIRIE, A. HOWARD. 549
POLAK, JOHN OSBORN. 500
REDER, FRANCIS. 96
REYNOLDS, EDWARD. 588
RHODES, ROBERT L. 546
ROBLEE, W. W. 675
SATTERLEE, HENRY S. 235
SCHMIEGELOW, E. 339
SCHUBERT, GOTTHARD. 376
SEIFERT, M. J. 59
SHAW, WILLIAM FAWCETT. 793
SHERMAN, HARRY M. 131
SHERREN, JAMES. 564
SMITH, RICHARD R. 504
SPEED, KELLOGG. 73, 120, 373
SQUIER, J. BENTLEY. 91
STRASSMANN, P. 53
STRAUS, DAVID C. 410
SUDLER, MERVIN T. 761
SWENSON, CARL G. 114, 120
TAGE-HANSEN, CAI. 152
TAIT, DUDLEY. 131
TARNOWSKY, GEORGE DE. 169, 254
TAUSSIG, FRED J. 218
THEILHABER, A. 650
THOMAS, B. A. 390
THOMSON, SIR ST. CLAIR. 679
THORNTON, W. LAWSON. 234
TOREK, FRANZ. 1
TRACY, STEPHEN E. 734
TUBBY, A. H. 796
TURNER, G. GREY. 545
TYLER, GEORGE T. 418
UNDERHILL, A. J. 118
VERBRYCKE, J. RUSSELL. 370
WATKINS, THOMAS J. 392
WEIBLE, RALPH E. 644
WHITE, CHARLES STANLEY. 679
WILSON, THOMAS. 456

275635

SURGERY, GYNECOLOGY AND OBSTETRICS

AN INTERNATIONAL MAGAZINE, PUBLISHED MONTHLY

VOLUME XIX JULY, 1914 NUMBER 1

INTERPLEURAL PNEUMOLYSIA[1]

AN OPERATIVE PROCEDURE IN PULMONARY TUBERCULOSIS

BY FRANZ TOREK, A. M., M. D., NEW YORK CITY

Surgeon to the German Hospital of New York and the New York Skin and Cancer Hospital; Adjunct Professor of Surgery in the New York Post-Graduate Medical School

IT seems to be generally acknowledged that the pneumothorax treatment of tuberculosis of the lungs according to the methods of Forlanini and Murphy is of value in combating that disease, inasmuch as, in suitable cases, it meets the indication of giving the diseased organ more or less functional rest, of permitting the fibrous tissue to contract about tuberculous foci, encapsulating them, and of causing lung cavities to collapse, discharge their contents, and in some cases to become obliterated. The pneumothorax treatment will not bring about these results under all circumstances, but only, as I stated, in suitable cases; their accomplishment depends upon the degree of collapse of the lung which the introduction of gas into the pleural cavity is capable of establishing. Now, it is well known that in many cases of pulmonary tuberculosis the adhesions are so extensive that the pleural cavity is practically if not completely obliterated. In such cases it is plainly impossible to inject the nitrogen. In other cases, where only a limited portion of the pleural cavity is free from adhesions, the collapse of the lung produced by the injection of nitrogen will be too slight to be of much, if any, value. In many cases in which the pneumothorax treatment had been established, the X-ray pictures revealed the fact that, while the lower part of the lung collapsed to a slight or fair degree, the upper portion remained entirely uninfluenced. The expected obliteration of cavities in the upper part through collapse of the lungs, therefore, could not ensue or only to a limited degree.

In these cases the operation of extensive removal of the ribs on the affected side from the first or second to the tenth or eleventh, according to Friedrich and others, has been practiced, the object being to cause the entire chest wall to collapse with the lung. The desired effect, the collapse of the lung, is accomplished by this operation, but unfortunately the tuberculous patients whose lungs are so extensively adherent as to render the injection of nitrogen infeasible are apt to be in so weak a condition that they are hardly able to stand the extensive operation of practically depriving half of the chest of its bony frame. As a matter of fact, the death rate is rather high, though the chances are better if the operation is done in two stages, as recommended by Sauerbruch. The deaths after this operation occur either primarily as a result of shock, owing to the magnitude of the operation, or secondarily as a result of instability of the

[1] Read before the German Medical Society, March 2, 1914, before the Bronx Medical Association, March 4, 1914, and before the Surgical Section of the New York Academy of Medicine, May 1, 1914.

mediastinum (mediastinal fluttering), owing to the lack of support on that side of the chest from which the ribs were removed. The respiratory oxygenation of the blood is deficient, as the mediastinum is drawn to the unoperated side on inspiration and forced toward the operated side on expiration. In consequence, the lung on the unoperated side is neither satisfactorily expanded on inspiration nor properly emptied on expiration. The lack of support on one side of the chest is also responsible for a certain amount of to-and-fro breathing between the two lungs, the expired air from the better lung being to some extent forced into the collapsed lung and breathed back again on inspiration. Of course, the air thus passing from lung to lung does not become oxygenated. Tight strapping of the operated side overcomes these difficulties to some extent.

In view of these facts the problem presented itself to me whether the collapse of the diseased lung could be accomplished by an operation which would not only be simpler than that referred to above, but would also preserve the bony frame of the chest. The solution of this problem appeared to me to be found in the intrathoracic separation of the adhesions between the visceral and the parietal pleura, "interpleural pneumolysia," as I have called it,— from "lysis," a loosening, which in accordance with Greek usage is changed to "lysia" when compounded with another word not a preposition. The modifier "interpleural" is employed to distinguish the method from that of separating the parietal pleura from the chest wall. Tuffier, for instance, in resecting the apex, separates that portion of the parietal pleura which covers the apex from the chest wall, but leaves the parietal pleura attached to the visceral pleura. Baer liberates the costal pleura over the apex in a similar manner without, however, resecting the apex.

The method of operating is as follows: Anæsthesia is conducted by intratracheal insufflation or other methods of differential pressure to guard against the possible occurrence of respiratory accidents. An incision of ample dimension, about six inches, is made in the sixth or seventh intercostal space, at the posterolateral aspect of the chest, down to the pleura, and after all hæmorrhage has been stopped the pleura is opened. The patient is now placed with the head low, so that if in the course of the manipulation of the lung the contents of a cavity are expressed, they may run into the mouth and not into the opposite lung. The adhesions between the two layers of pleura are then separated. This is accomplished by introducing at first only the tip of a finger to separate the adhesions in the immediate vicinity of the incision, the ribs being held apart by retractors. The separation then proceeds further and further, until finally the whole hand is introduced into the chest in order to liberate the more distant parts of the lung. In the course of this procedure bands of adhesions may be encountered that are so dense as to require division with the aid of scissors. When the separation of adhesions has been completed, the lung will collapse as much as the degree of its infiltration will permit; it is allowed to remain in this state of collapse and is not inflated before closing the thorax. The pleural cavity is closed without drainage. The two ribs which had been spread apart are brought in apposition by pericostal sutures of silk or chromicized catgut, the muscles are sutured with catgut, and the skin with silkworm-gut.

Following this operation there is none of the pain that is often experienced in the ordinary pneumothorax treatment after the injection of nitrogen, a pain that is doubtlessly due to the fact that the injected gas causes sufficient pressure on the lung to stretch some of the adhesions. After the operation no tugging on the pleura can take place, although the collapse of the lung is extreme, and this circumstance explains the absence of pain.

Subsequent treatment is similar to that given in the ordinary pneumothorax method. Physical examination, especially with the aid of the X-ray, must determine to what extent reabsorption of the air has taken place and whether it is time to make an injection of nitrogen.

Mention must be made of an accident that may occur in the course of the operation. If a cavity in the lung extends well to the pleura, the wall of this cavity may be injured during

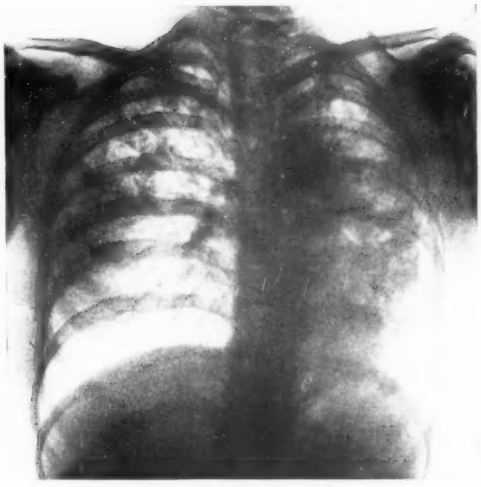


Fig. 1. Pulmonary tuberculosis. Extensive involvement of left lung and involvement of upper and middle lobes of right lung. A large cavity in the left lung near its root. The adhesions in the left pleura have drawn the heart, trachea, and bronchial tree well to the left.

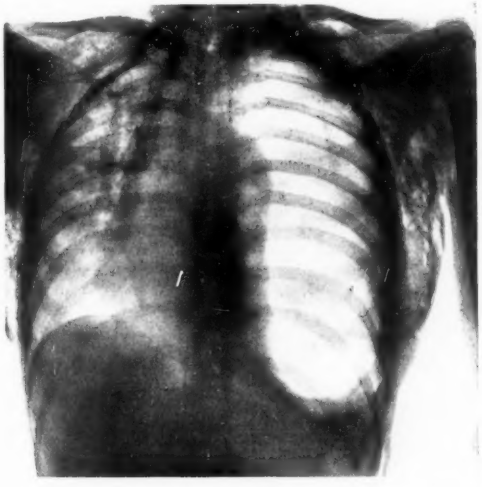


Fig. 2. Nine days after operation. Left lung completely collapsed. Left pleura filled with air. The mediastinal organs are now markedly displaced to the right. The lung cavity is no longer to be seen. Note the subcutaneous emphysema at the margins of the picture.

the process of separating adhesions. In that case the inspired air will gain access to the pleural cavity through the lung. If then, owing to a valve-like action of the tear in the wall of the lung cavity, this air is prevented from returning through the bronchus as easily as it entered, the pleural cavity will continue to fill with air until the intrapleural pressure forces it out between the two ribs that had been separated. In consequence, a subcutaneous emphysema will result, the closure of the skin as a rule preventing the air from passing out. The probability also exists that the pleura will be infected from the lung cavity.

It is evident, therefore, that one should aim to avoid this accident by proceeding with particular caution when separating the adhesions over the lung cavity, the site of which has been accurately localized in advance. In a case like that represented in Fig. 1, where the cavity is situated rather close to the median line, one might very well consider leaving the adhesions over it undisturbed, as their presence would not prevent the lung from sinking in toward the mediastinum. If one has reason to believe that a perforation of the wall of a cavity has taken place, the site of the lesion should be determined with the aid of artificial inflation of the lung and the wound repaired by inverting the torn edge and inserting seroserous sutures. For the purpose of applying the stitches the lung should be made to collapse again.

In the case described below an injury to a large cavity did occur, and extensive subcutaneous emphysema promptly set in, but at first no infection of the pleura resulted, the patient's temperature after the end of the first week ranging between 99 and 100, although for many weeks previous to the operation it had been as high as 102 or 103 in the evening, with morning remissions. Later, however, an infection manifested itself. The main points of the history are as follows:

Mrs. K. W., 30 years old, had been coughing for a long time, more so in the last two months than previously. For five weeks she has had daily chills followed by fever. She is very weak, very anæmic, and poorly nourished. Chest expansion poor, especially on the left side. Over the entire left lung subcrepitant râles are heard both on inspiration and on expiration.

Seven weeks after her admission to the hospital she was brought under my observation with the request that the pneumothorax treatment be given.

On examination I became convinced that the left lung was adherent to such an extent as to render that treatment impossible. I also found the evidence of a large cavity in its upper part. A pair of stereoscopic X-ray plates taken by Dr. William H. Stewart, one of which is reproduced in Fig. 1, revealed an extensive tuberculous process in the left lung. Between the fourth and sixth intercostal spaces, near the root, a large cavity partially filled with material is seen. Marked and extensive pleuritic adhesions are present, drawing the heart well over to the left and producing a certain amount of scoliosis. These adhesions are also displacing the trachea and the bronchial tree well to the left. The left bronchus can be distinctly seen to be in direct communication with the large cavity. There is also an involvement of the upper and middle lobes of the right lung.

The operation above described was performed Jan. 26, 1914, under intratracheal insufflation anæsthesia. The lung did not collapse on opening the pleura owing to dense adhesions all over the lung attaching it to the parietal pleura. They were firmest at the apex, requiring the use of scissors at one place to liberate the lung. The collapse of the lung was not complete owing to the infiltration of the organ, which was most marked in the upper lobe. The surface of the lung was studded throughout with tubercles of greater or less size. On mopping the pleural cavity previous to closing it, some broken-down tuberculous material was seen on the gauze mop, an evidence that the cavity in the lung had been injured. The thorax was closed without drainage.

Soon after the completion of the operation a subcutaneous emphysema developed which spread rapidly over the trunk and after some time also involved the left side of the face. On the following day it extended over the whole face. The explanation of this occurrence is evident. Inasmuch as the injured lung cavity was in direct communication with a bronchus, the inspired air easily gained access to the pleural cavity, but, owing to a valve-like action of the lacerated tissues, could not readily return the same way.

The emphysema began to subside on the fourth day and was no longer visible at the end of two weeks, though the crackling of the air could still be felt. On the second and third day after operation the patient coughed frequently, but subsequently very little, the cough being completely absent for several days in succession. On the first four days occasional marked dyspnœa was noted; this subsided later on and finally disappeared. The temperature rose at first, then declined, and at the end of the first week fluctuated between 99 and 100. An X-ray picture (Fig. 2), taken nine days after the operation, reveals a complete collapse of the left lung, the pleural cavity being filled with air. The mediastinal contents, including the heart, are now markedly displaced to the right. The cavity in the lung can no longer be seen. On comparing the two plates the first impression is as if the second plate had been reversed, as the right half of the thorax, which harbored the better lung, now presents the hazier picture, while the more diseased left side, on account of the pneumothorax, is of course perfectly clear. The displacement of the mediastinal organs still further heightens the illusion. At the margins of the picture an interesting representation of the subcutaneous emphysema is seen. Toward the end of the second week the temperature rose again, and in the course of the third week the presence of a discharge gave evidence that an infection had taken place. After this had been satisfactorily evacuated the temperature dropped again. The patient's chances now seemed favorable, but in the beginning of the fifth week a profuse and intractable diarrhœa set in which weakened the patient to such an extent that she succumbed within two days after its onset.

Now, what deductions can we draw from this case? Although from the very start a cure could not possibly be expected in this case on account of the advanced disease of the opposite lung, yet some conclusions of importance can safely be accepted. In the first place, the operation itself was well borne by the very weak patient, who was declared by the visiting physician of the hospital, Dr. Richard Stein, to be an absolutely hopeless case near death; secondly, there was the marked diminution of the cough after the third day; thirdly, the drop of the temperature to practically a normal range in the second week; and fourthly, the disappearance of the cavity in the X-ray picture,— not to speak of the subjective improvement. Finally, the operation is easy of performance, the only point of importance in the technique being to avoid injuring a cavity. Had I been warned of the possibility of this accident occurring, I would surely have taken a little more time in separating the adhesions; but, inexperienced as I was, I imagined that utmost speed in performing the operation was the matter of prime importance.

The operation of interpleural pneumolysia, in my opinion, is to be considered in cases of pulmonary tuberculosis in which the ordinary pneumothorax treatment would be indicated— in which, however, the extent of the adhesions is so great that it either cannot be executed at all or would bring about but an imperfect collapse of the lung. In cases of bronchiectasis, it appears to me, a similar indication would hold good.

STUDIES ON THE FUNCTION OF THE PERIOSTEUM[1]

By J. E. MOORE, M. D., Minneapolis
Chief of the Department of Surgery, University of Minnesota
AND
J. FRANK CORBETT, M. D., Minneapolis
In Charge of the Experimental Division, University of Minnesota

In 1739 the French naturalist, Duhamel, advanced the idea that bone grew from periosteum like an exogenous stem rises from the inner layer of the bark. However, the surgical profession and the pathologists did not generally pay attention to this subject for a good many years. For illustration we refer to the following authors: Baillie (1795), in "Morbid Anatomy," makes no reference to the periosteum. Notwithstanding the fact that Cooper wrote concerning the open treatment of fractures, there is no mention of the periosteum in Cooper's Surgery (1819). Williams' Principles of Pathology deals very vaguely with ossification. In "Principles of Surgery," by James Miller (1845), osteitis and periosteitis are described. With the advent of the school of pathologists instituted by Dupuytren and Cruveilhier, interest was at once awakened in the periosteum. These observers attributed to the periosteum osteogenetic qualities; and Virchow, in 1858, in his work on cellular pathology, affirms that bone-cells arise by a process of metaplasia from the periosteum. This view was reënforced by Gegenbauer, and it was not until Senn's time that this teaching began to be disputed. Senn taught that provisional callus was the product of the periosteum, and that permanent callus was from medullary bone. Macewen, in 1887, demonstrated that bone regeneration could take place in human fractures without the aid of periosteum.[2] In 1885 Pilcher[3] reviewed Trueheart's attempt to graft the periosteum in a defect of the clavicle. Macnamara (1887) speaks of bone grafting by the periosteum. However, the results of the last two rather conclusively show that the periosteum was not the immediate author of actual new bone. The more recent principles laid down by Macewen clear the atmosphere, although these are somewhat obscured by the conclusions of Haas and the experiments of Schepelmann. Albee's work does not vitiate Macewen's principles, in that in his work periosteal new bone apparently was produced by the periosteum furnishing a rallying point for the stimulated osteoblasts in irritated bone. From Ollier's work in 1860, and from the work of Barth, one concludes the periosteum not to be a material factor in the regeneration of bone grafts. Murphy corroborated these findings. Carrel, by means of *in vitro* cultivations of sound periosteum, with a resulting product of bone-cells, does not show that periosteum produces bone, as he has not proven that bone-cells were not included in his periosteal grafts.

It is a reasonable law in biology that all tissues are developed from cells of the same tissue. If, as has been commonly believed, periosteum produces bone-cells, it must be an exception to this general law, because it is a connective-tissue membrane and in accordance with this law can only produce like connective-tissue cells, and not highly differentiated connective tissue such as bone.

The diversity of opinion expressed by various observers is probably due to the fact that the function of the periosteum in adult bone is slightly different from that of young bone, and vastly different from that of irritated bone. From the work of Macewen, we know that in normal adult bone the periosteum is a limiting membrane. In growing bone it furnishes a potential space for peripheral bone. In hyperæmic or irritated bone, it serves as a refuge for the osteoblasts, and gives sufficient framework for new bone.

As to the relation between cartilage and

[2] Ann. Surg., Phila. vi.
[3] Ann. Surg., Phila., 1885.

[1] Read before the Western Surgical Association, December, 19, 1913.

periosteum, we have the following apparently paradoxical conditions:

New diaphyseal bone develops in cartilage.

Subperiosteal bone apparently develops without cartilage in a growing bone.

In drill-hole fractures, in which the periosteum may be ignored, there is practically no cartilage.

In complete fractures involving the periosteum, cartilage is present.

Bones deprived of periosteum and then completely fractured heal without cartilage.

Free periosteum does not produce cartilage.

Therefore, Macewen's principles laid down for osteoblasts hold good in cartilage-cells.

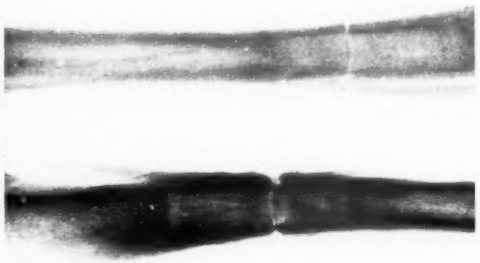


Fig. 1. Animal Experiment No. 227. Animal experiment in which the nutrient artery was cut, the bone irritated and no subperiosteal osseous tissue resulted. Taken 12 days after operation.

Fig. 1a. Taken 43 days after operation.

From a very early period various important functions have been attributed to the periosteum which did not properly belong to it. One by one these functions have been removed, until now we are trying to take from it the last and most important rôle attributed to it, that of bone-producing power, and to reduce it to the humble position of a protecting membrane. Up to within a very few years, osteomyelitis was spoken of as periosteitis, and now we know that the periosteum plays a comparatively insignificant part in this important disease. It was once believed that when a bone was stripped of its periosteum, necrosis would surely follow. It is now known that a bone may be stripped of its periosteum and, so long as its other sources of blood supply are unimpaired, necrosis does not follow.

The late Stephen Smith advocated at one time the formation of periosteal flaps in amputation of the extremities. We soon learned that when this flap was made, the tendency was to the formation of a conical stump, and the results were not satisfactory. In the light of our present knowledge, the conical end of the bone was formed in the presence of the periosteum, not because the periosteum produced bone, but because it confined the osteoblasts to a limited space.

Fig. 2. Subperiosteal bridge, from Museum, University of Minnesota.

When the periosteum is not placed over the end of the bone, it heals very smoothly without excess of bone formation because the excess of the osteoblasts have disappeared in the tissues.

The late Professor Sayre insisted very strenuously that in excision of the hip the periosteum should be preserved.

By subperiosteal repair we mean the formation of an involucrum beneath the periosteum. This is a common occurrence in osteomyelitis, but in a modified form may occur as a result of irritation without actual infection. Exclusive of osteomyelitis, there are references to subperiosteal repair occurring in the early literature. Celsus speaks of

hastening repair in some cases of ununited fractures by irritating the ends of the bone. Physick advocated the use of setons. These are only indirect references, and are not intended to convey the idea that the authors understood the immediate result of their procedures. The army records of the Civil War abound with numerous examples of subperiosteal repair, of which we show one example. Equally striking examples are found in the University of Minnesota Surgical Museum, of which we show two examples. These specimens were partially the result of infection.

More recently J. B. Murphy has called our attention to the occurrence of subperiosteal repair of bone when the segments are held apart by magnesium rods. The occurrence of subperiosteal repair is apparent in the work of Albee, and many others of our more recent writers.

Many striking examples of this phenomena occurred in a series of experiments undertaken with the idea of discovering some osteoconductive substance other than autoplastic bone. The work of Fraenkel, Billroth, Gerster, and Elsberg has shown that inert foreign bodies in bone become encysted with connective tissue, while the work of Senn, Curtis, and Murray, with decalcified bone chips, showed that in mere cavities bone replaced absorbable material. In our experiments actual segments were cut from the shaft of bone, and when healing occurred the results were entirely different from those mentioned above.

Therefore, we will detail these experiments. These are not shown for their immediate surgical value, but rather to emphasize certain principles. Various substances were used—wooden tubes, sponge, horn of various kinds, ivory, autoplastic transplants, and blood-clot. From this series of experiments we selected examples of subperiosteal repair for the subject of this paper. The results of such experiments radically differed when the nutrient artery was cut, and when it was not cut.

In the first experiment the tibia was cut in two with a Gigli saw. The periosteum was not interfered with beyond the line of saw cut. The medullary canal was then reamed out, and a wooden insert made. In this case the bone was contacted with bone. Last of all, the nutrient artery was destroyed. This left the bone with only the blood supply from the epiphyseal artery and collateral circulation through the periosteal vessels.

This was sufficient to maintain the vitality of the bone, but no well-marked subperiosteal involucrum formed. In this experiment the periosteum was left with all its properties, but the osteoblasts were not stimulated by increased blood pressure in the medullary bone as they would be with normal blood supply.

Fig. 3. Animal Experiment No. 206. In this experiment a defect in the shaft of the tibia was filled with sea sponge. Note subperiosteal bridge and complete function after three months.

Fig. 4. Animal Experiment No. 228. In this experiment a defect was made in entire shaft of tibia, including periosteum. A piece of horn kept fragments apart. Note deposition of bone in area not covered by periosteum. X-ray 79 days after operation.

Animal Experiment No. 227. Operated July 16, 1913; X-ray taken on July 28, 1913; again X-rayed on August 28, 1913, and autopsy on September 12, 1912. Result: non-union. Absorption of bone in region of insert. Practically no subperiosteal callus. No function.

In the next experiment the nutrient artery was left intact, and both abundant periosteal and endosteal bone resulted. The following experiment also shows the occurrence of periosteal bridge in bone with a normal blood supply.

Animal Experiment No. 206. Segment removed with bone-cutting forceps. Bone held apart with Lane plate. Decalcified sponge was placed between the ends of the shaft. Operation on June 26, 1913. X-ray on July 10, 1913. Showed marked thickening of the shaft of the bone, and deposit of subperiosteal bridge. On July 28, 1913, X-ray showed nearly

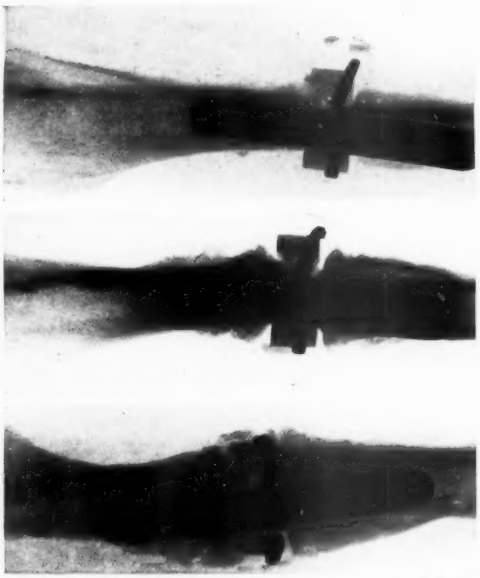


Fig. 5a. Animal Experiment No. 236. Defect in shaft of tibia surrounded by horn ferrule. Phosphor-bronze plate. X-ray at end of 25 days.
Fig. 5b. X-ray at end of 50 days.
Fig. 5c. X-ray at end of 71 days.

completed bridge. X-ray, on September 23, 1913, showed complete bridge. In this case there was a perfect functional result, and no exudate, sinus, temperature, or other evidence of infection. Post-mortem on September 27, 1913. Subperiosteal bridge demonstrated.

The next animal experiment, No. 228, shows that the periosteal bridge may extend beyond the normal confines of the periosteum. Fragments were held apart with bone inserts and Lane plate. Operation on September 9, 1913. X-ray on October 13, 1913, shows new subperiosteal bone. This extends beyond the periosteum and begins to bridge

Fig. 6. Animal Experiment No. 12141. In this experiment the periosteum was removed from entire circumference of bone. A channel was cut in the bone, and continually irritated. Over this defect a piece of fascia was secured. New bone formed under the fascia, but not elsewhere.

the gap. It looks as though the greatest production of bone had been near the middle of the defect and where there was no periosteum. On November 18, 1913, bridge nearly complete. Shows also anastomosis with the fibular endosteal bone. Autopsy on November 29, 1913. Shows bone to be subperiosteal.

Animal Experiment No. 236. Defect was made in the shaft of the tibia, and a ferrule of horn was placed in this defect. The ferrule was of sufficient size to barely admit the ends of the cut bone. The ends of the mutilated shaft were held apart with phosphor-bronze plate. X-rayed on October 24, 1913. Showed slight subperiosteal deposit. X-ray on

Fig. 7. Enormous subperiosteal bridge complicating fracture of the internal condyle. Operated at the University hospital clinic by Dr. A. A. Law

November 18, 1913, shows periosteal bone apparently deposited outside of the defect. X-ray on December 9, 1913. Tumor-like mass of bone covering horn ferrule.

These experiments show enormous subperiosteal developments and offer a marked contrast to the results with Lane plates. In our plate work the periosteum plays no great part in the process of repair unless the plate causes irritation. This is emphasized by the fact that following Lane's method of repair, there is practically no increase in the diameter of the bone.

Heterotopic transplants of bone produce no subperiosteal bone as shown by the following experiments:

Animal Experiment No. 12138. Shows a piece of femur with periosteum transplanted to the anterior muscular abdominal wall. This has undergone slow atrophy, as may be seen in the X-rays taken six and twelve months afterwards.

Animal Experiment No. 13140. Shows a piece of skull transplanted to a similar place, and undergoing a similar fate.

Animal Experiment No. 210. A piece of epiphyseal cartilage and bone was transplanted, without any periosteum, to the anterior abdominal wall. Shows a beginning growth of bone after five months.

In all these experiments, the bone was irritated and functionated, but no new subperiosteal bone resulted. This may be attributed to lack of blood supply, or in one case to a very scant blood supply. The bone transplanted without periosteum is of too short life to tell the final results.

Animal Experiment No. 238. Shows result of infection and irritation. The bridge is thicker and more closely confined to the periosteum than is usual with irritation alone.

Animal Experiment No. 12141. Shows the result of substitution of fascia for periosteum.

The conclusions from these studies are these:

Cutting the nutrient artery prevents the formation of subperiosteal bridge. As the nutrient artery supplies medullary bone, and as the periosteum is left intact when the artery is cut, we may assume that the medullary bone is responsible for the subperiosteal bridge.

Subperiosteal bridge may fill in gaps left in the periosteum, therefore is not absolutely dependent upon that structure even as a place of refuge.

Subperiosteal bridge is more marked where it receives osteoblasts from two sources than from one.

Fascia is a substitute for periosteum.

In heterotopic transplants, no subperiosteal bone could be produced by irritation. This is somewhat surprising in that the heterotopic experiments were conducted upon rabbits. We know that old scars in these animals frequently contain true bone, and that the periosteal device of Schepelmann begot bone in the peritoneal cavity.

At the present day the periosteum is disregarded. The present day surgeon may be comparatively indifferent to the periosteum when operating upon bone. If it is convenient he preserves it, because the conservation of tissues is always good surgery; but if it is not convenient, he does not hesitate to sacrifice it, knowing that it is not an essential element in the healing of bone.

Credit is due Dr. Frank Bissel for the X-ray work.

BIBLIOGRAPHY

MURPHY, J. B. Osteoplasty. Surg., Gynec. & Obst., 1913, xvi, 403.

MURPHY, J. B. Contribution to the Study of Bones, Tendons and Joints. J. Am. M. Ass., lviii, p. 1094.

GASK, G. E. Autoplastic Graft of Fibula into Humerus after Resection of Chondrosarcoma. Brit. J. Surg., i, p. 49.

DAVID, MAX. Histological History of Dead Bone and Ivory Implanted in Cranial Defects. Arch. f. Klin. Chir., lvii, p. 533. Reviewed in Ann. Surg., Phila., xxix, p. 290.

COLVIN, A. P. A Brief Survey of the General Knowledge of Bone Regeneration. Surg., Gynec. & Obst., 1907, v, 566.

SCHUCHARDT. Die Krankenheilen des Knochen und Gelenke. Deutsche Chir. Lieferung., xxviii. Quoted by Colvin.

MACNAMARA. Diseases of the Bones and Joints. (1887)

MACEWEN, WM. The Osteogenetic Factors in the Development and Repair of Bone. Ann. Surg., Phila, vi, p. 289; Medical and Surgical History, Civil War. Part 2, Surg. Vol.

COOPER, SAMUEL. Practice of Surgery. (1819)

BAILLIE, MATHEW. Morbid Anatomy. (1795)

WILLIAMS, M. Principles of Pathology. (1843)

MILLER, J. Principles of Surgery. (1845)

VIRCHOW. Cellular Pathology. (1858, p. 467)

SENN. Principles of Surgery. (1890)

PILCHER. Periosteum Grafting. Ann. Surg., Phila., ii, p. 514.

MACEWEN. The Growth of Bone. (1912)

HAAS. The Regeneration of Bone from Periosteum. Surg., Gynec. & Obst., 1913, xvii, 164.

SCHEPELMANN, EMIL. Freie Periostverpflanzung experimentalle Untersuch. Arch. f. klin. Chir., 1013, ci, 409.

ALBEE, F. H. An Experimental Study of Bone Growth and the Spinal Bone Transplant. J. Am. M. Ass., lx, p. 1044.
BARTH. Histologische Untersuchungen über Knochen. Ziegler Beitr., xvii.
CARREL, A. Growth of Tissue. J. Am. M. Ass., lix, p. 525.
SENN. Bone Chips. Am. J. M. Sc., 1889, Sept., ii, 219.
MILLER, A. G. A Case of Bone Graft with Decalcified Bone Chips. Lancet, Lond., 1890, Sept. 20, p. 618.
MURRAY, R. N. Bone Grafting by Decalcified Chips. Lancet, Lond., 1890, Oct. 4.
GERSTER. Osteoplastic Repair of Defect of Tibia. Tr. Am. Surg. Ass., xiii, p. 485.
HAMILTON, T. B. J. Anat. and Physiol., xiii, Edinburgh. M. J. 1881, p. 385.
SCHEDE. Über Heilung der Wunden unter dem feuchten Blutschorf. German Congress Surgeons, 1886.
LAUENSTEIN. Zur Heilung der Wunden unter dem feuchten Blutschorf. German Congress Surgeons, 1888.
CURTIS. A Case of Bone Implantation and Transplantation. Am. J. M. Sc., 1893 cvi, p. 30.
JANEWAY, HENRY E. Autoplastic Transplantation of the Bone. Ann. Surg., Phila., lii, p. 217.
MAJREST, E. R. Bone Plastic for Skull Defects. Ann. Surg., Phila., li, p. 516.
ALLISON, C. C. Direct Implantation of Bone Grafts. Surg., Gynec. and Obst., 1910, x, 303.
MCWILLIAMS, C. A Discussion of Bone Transplantation and the Use of a Rib as a Graft. Ann. Surg., Phila., lvi, p. 377.
CODMAN, E. Bone Transference. Ann. Surg., Phila., xlix, p. 820.
MACEWEN, S. W. Intrahuman Bone Grafting and Reimplantation of Bone. Ann. Surg., Phila., l, p. 959.
BUNTING, C. H. The Formation of True Bone with Cellular (red) Marrow in a Sclerotic Aorta. J. Exp. Med., viii, p. 365.
BUERGER, L., OPPENHEIMER, A. Bone Formation in Sclerotic Arteries. J. Exp. Med., x, p. 354.
PEARCE, R. M. Notes on the Later Stages of the Repair of Kidney Tissue (dog) with Special Reference to Proliferation of the Pelvic Epithelium and Heteroplastic Bone Formation. J. Med. Research, xx, p. 53.
KERR, N. The Growth of Bone against Resistance. Surg., Gynec. & Obst., 1910, x, 396.
MAGRUDER, E. P. Bone Grafting and Osteoplasty. A Case of the Latter Presented. Surg., Gynec. & Obst., 1910, xi, p. 193.

AN EXPERIMENTAL STUDY OF SILK–TENDON PLASTICS WITH PARTICULAR REFERENCE TO THE PREVENTION OF POST–OPERATIVE ADHESIONS

BY CARL WM. HENZE, M. D., NEW HAVEN, CONNECTICUT, AND LEO MAYER, M. D., NEW YORK CITY

THOUGH there is no longer any question of the feasibility of the Lange silk-tendon plastic for the lengthening of transplanted tendons, certain problems in the technique of the operation have not, as yet, been fully answered. Chief among these is a satisfactory method of preventing post-operative adhesions. Lange himself has partly solved the problem by running the silk and the transplanted tendon through the subcutaneous fatty tissues. Though this method frequently gives excellent results, there always remain a number of cases in which an effective functioning of the transplanted tendon is rendered impossible by adhesions too firm for even a powerful muscle to overcome.

The following experimental study was undertaken at Professor Lange's suggestion to determine the nature of these adhesions and if possible to find a satisfactory method of preventing their formation. With this as the prime object of our work there were also a number of secondary points at issue. They were, first, the nature and mode of development of the tissue which forms about the silk strands; second, the effect of function on this tissue; third, a determination on experimental data of how long the post-operative fixation must be maintained; fourth, the degree and nature of the trauma inflicted on the transplanted tendon by threading the silk through it.

A statement of certain facts relative to the Lange silk-tendon plastic is a necessary preliminary to the exposition of our own findings.

The Lange operation for replacing a paralyzed muscle consists in freeing the tendon and lower portion of a healthy muscle, so placed as to be a suitable substitute, and threading it with two to eight strands of silk. The threading is done by a stitch devised by Prof. Lange (Fig. 1a). Recently it has been shown by Schede, working in Lange's clinic, that the strength of the stitch is increased by making

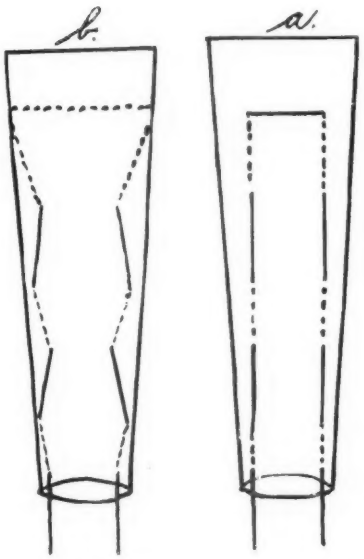


Fig. 1. Diagram illustrating the Lange tendon stitch and the Schede modification. A, Lange method. B, Schede modification.

the longitudinal lines somewhat irregular instead of keeping them in the same plane (Fig. 1b). The tendon and the silk are then drawn through a tunnel in the subcutaneous fatty tissues to a point near the insertion of the paralyzed tendon, where, by attaching the silk to the periosteum and underlying cartilage or bone, a line of traction is established corresponding as nearly as possible to that of the inactive muscle. The adhesions which Lange has noted usually occur near the anterior surface of the tibia. They seemed to occur between the silk strands and the periosteum in those instances where it had been impossible to interpose a layer of fatty tissue, but their exact study has never been undertaken.

After a successful Lange operation the silk can be felt as a distinct subcutaneous cord which gradually increases in size until frequently it reaches the diameter of an ordinary lead pencil. On three occasions Lange has had opportunity to examine this artificial tendon after it had functionated for two or more years. In all three the findings were essentially the same. The silk entirely unabsorbed, in one instance with a connective-tissue core, was

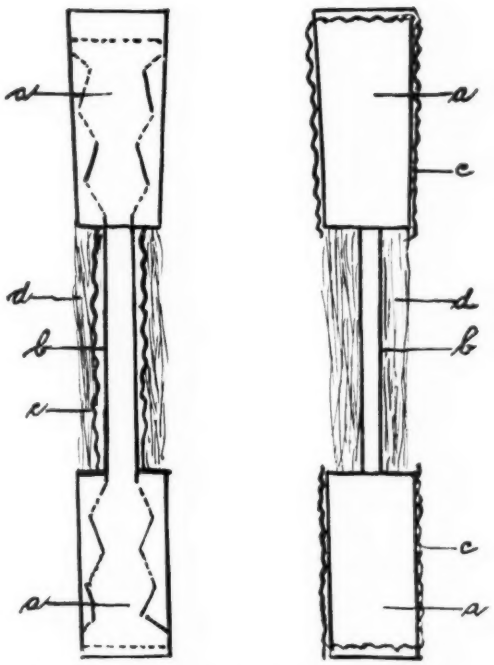


Fig. 2. Diagram illustrating the control experiments — I1 and I3. a, tendon ends; b, silk; c, Cargile membrane; d, new-forming tissue connecting tendon ends.

encased by a dense fibrous tissue, which in the opinion of several expert microscopists was considered identical with true tendon.[1]

It is unnecessary to rehearse in detail the extensive literature dealing with the healing of tendon wounds. The earlier researches of Pirogoff, Bizzozero, Paget, Adams, Dembowski, Velpeau, Billroth, Beltzow, von Ammon, Boner, Feltz, Güterbock, and the more recent work of Viering, Busse, Enderlen, Schradick, Kraus, Yamagiva, Marchand, and Seggel have shown that the tendon ends are rapidly united by a scar tissue to which the tendon sheath, adjacent connective tissue, peritendinium externum and internum, and the tendon-cells proper contribute in varying proportion. Eventually the tissue assumes the

[1] Through the courtesy of Prof. Oberndorfer, Prosector of the Schwabing Hospital, we were allowed to examine these specimens. We cannot concur in the opinion that the tissue surrounding the silk is identical with true tendon. Though functionally equivalent to tendon, it differs from true tendon, first in being more vascular, second in the absence of grouping into primary, secondary and tertiary bundles, third in the character of the cells; these are elongated connective-tissue cells rather than true tendon-cells.

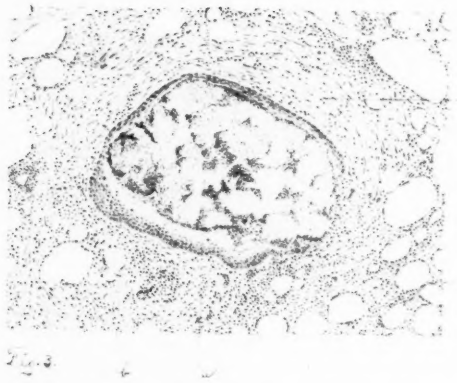


Fig. 3. Camera lucida drawing of fat-transplantation surrounding the silk tendon, ten days post-operative. Cross-section, showing the fibrous tissue replacing the fat. Experiment B1. Immobilized ten days. Objective Leitz 3. Ocular 1. Tube 145. a, silk; b, envelope of epidermal cells transplanted with the fat; c, fibrous tissue replacing the fat transplant; d, fatty tissue.

microscopical characteristics of tendon, though even after 90 days it is much more cellular than normal (Seggel) and even after 243 days

Fig. 4. Camera lucida drawing of artificial tendon sheath operation, thirteen days post-operative, showing (1) the organization of the blood-clot about the silk by fibroblasts ranged parallel to the silk, and (2) the cleft between the artificial tendon and the sheath. Experiment K2. Immobilized thirteen days. Objective Leitz 3. Ocular 4. Tube 140; a, silk; b, blood-clot; c, fibroblasts; d, cleft between artificial tendon and sheath; e, flattened endothelial like cells of sheath; f, blood-clot in sheath.

Fig. 5. Camera lucida of artificial tendon, distal segment, fifteen days post-operative. The silk was drawn through the subcutaneous areolar tissue. The tendon stump in the proximal segment shows extensive necrosis and no evidences of regeneration. Despite this fact, a well developed pseudotendon composed of dense connective tissue has already developed about the silk. Experiment L3. Immobilized fifteen days. Objective Leitz 3. Ocular 0. Tube 140. a, silk; b, loose cellular tissue composed of polyblasts, leucocytes, lymphocytes, fibroblasts, etc.; c, dense connective tissue, its cells and fibers parallel to the silk; d, loose subcutaneous areolar tissue.

it has not the peculiar shimmer characteristic of normal tendon (Schradick).

Borst and Seggel have also studied the changes after tendon plastics. In eleven operations performed by Hoffa — reefing of tendons, lengthening, and suture of one tendon to another—and in fourteen similar experiments of his own, Borst noted that healing takes place by a primary emigration of leucocytes and active proliferation of polyblast cells derived chiefly from the adjacent connective tissue. After the fourth day the true tendon-cells showed their participation in the scar formation by great increase in their number and by numerous mitoses. He was able to distinguish between the mitotic figures of tendon and connective-tissue cells, and thereby reached definite conclusions as to their relative importance in the regenerative process. He found that simple tendon sutures healed much more rapidly than

Fig. 6. Camera lucida drawing of newly forming tendon. A portion of the extensor digitorum tendon 1 cm. long was excised and further retraction prevented by uniting the tendon ends with the Lange stitch. The drawing illustrates the growth of true tendon-cells into the gap between the tendon ends. Control Experiment 12. Immobilized ten days; free ten days. Objective Leitz 3. Ocular 1. Tube 140. a, silk; b, loose cellular tissue surrounding silk; c, sheaves of young tendon-cells; d, connective tissue.

shortening by the Lange "reefing stitch," since in the latter a greater degree of necrosis was produced. This necrosis he considered due to the tension of the silk on the tendon.

Seggel, in addition to a study of the healing of tenotomies, performed sixteen plastics in which 3–4 cm. of the Achilles tendon were replaced by silk strands as in the Lange operation. Within thirty-eight days the tendon ends were united by young tendon tissue; the process was completed eight days earlier in the ventral portion where the tendon sheath had been left intact. In nine of his experiments the silk was either extruded or torn out of the tendon, without influencing, he thought, the reparative process. He concluded that neither tension nor function of the regenerated tissue determined its character, but merely influenced the size of the newly formed tendon. His conclusions, however, can not be accepted without criticism, since in no instance was he able to maintain fixation of the operated limb.

Levy reached an opposite conclusion. By extirpating the muscle after tenotomies and by inserting silk strands between the tendon

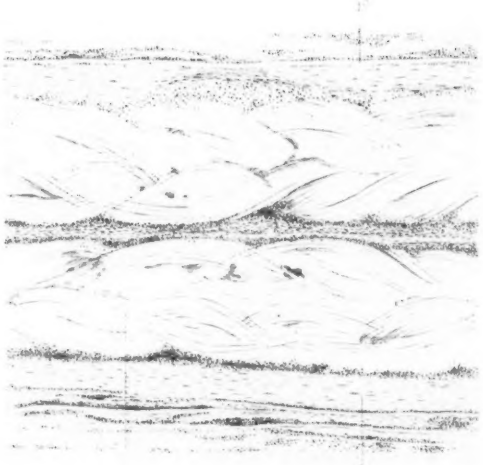


Fig. 7. Camera lucida drawing of artificial tendon, sheath operation twenty-nine days post-operative, showing the dense fibrous tissue of the new tendon and the retention of the cleft between tendon and sheath. Experiment K3. Immobilized twenty-nine days. Objective Leitz 3. Ocular 1. Tube 140. a, silk; b, fibrous tissue with longitudinal cells and fibers, closely resembling young tendon; c, cleft between artificial tendon and sheath.

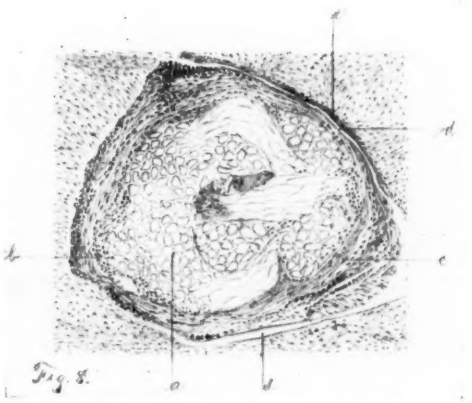


Fig. 8. Camera lucida drawing of cross-section of artificial tendon 44 days post-operative, sheath operation, showing (1) the cleft between newly formed tendon and the sheath, and (2) the presence of connective-tissue fibers encircling the silk. Experiment K1. Immobilized eight days; free thirty-six days. Objective Leitz 3. Ocular 4. Tube 140. a, silk; b, loose cellular tissue about silk; c, fibrous connective tissue showing circular as well as longitudinal fibers; d, cleft between tendon and sheath; e, sheath.

Fig. 9. Camera lucida drawing of artificial tendon, thirty-four days post-operative; the silk and tendon end were drawn through the subcutaneous areolar tissue and the animal allowed to use the limb freely for twenty-four days, after ten days' immobilization. The silk in this instance did not tear out of the tendon. The drawing illustrates the development of the artificial tendon, and of a surrounding loose connective tissue which allowed 3 mm. motion of the tendon. Experiment L2. Immobilized ten days; free twenty-four days. Leitz Objective 3. Ocular 4. Tube 140. a, silk; b, loose cellular tissue about silk; c, fibrous connective tissue, closely resembling young tendon tissue; d, loose connective tissue, allowing motion of the tendon.

stumps, pulling the new-forming tissue at right angles to the original line of traction, he showed that the cells and fibers of the new-forming tissue ran parallel to this artificial line of traction, and that the gap between the tendon ends was thus bridged by a tissue which, instead of running longitudinally, as after the usual tenotomy, ran transversely.

The most recent work on tendon plastics (Sever's) differs radically from the preceding in attributing no regenerative power to the tendon-cells proper. He considers the all-important tissues to be the tendon sheath and the peritendinium; unless they are present, true tendon regeneration is impossible. The peritendinium, therefore, corresponds in function to the periosteum. He found that if the sheath and peritendinium were preserved and function allowed "early," "adhesions may not occur." Without the sheath, adhesions occur more frequently.

Our attempt to solve the problem of preventing adhesions is based on 54 operations performed on rabbits of varying age, from young (two or three months old) to full grown. We include here only those cases in which healing was aseptic, except in one instance, where the microscopical evidence of a localized infection of the tendon stump enabled us to demonstrate an important point in the development of the artificial tendon. In the earlier operations the tendo Achillis was used and to lessen the tension on the sutures the leg was fixed in extension. This position, however, seemed to give the animals much inconvenience and prevented them from hopping about freely. We, therefore, used the muscles of the anterior and mesial groups — the tibialis anticus, extensor digitorum, extensor hallucis, and flexor digitorum. These tendons were indeed much smaller than the Achilles tendon and increased the difficulty of the operation, but by using them we could fix the leg in flexion. We immobilized and also kept the dressing dry and clean by coating the gauze bandage with celluloid dissolved in acetone. Absolute fixation was not possible, since owing to the give of the gauze about 5° of motion took place at the ankle-joint. The fixation, relative though it was, was an important part of the operative procedure, since by varying the period of immobilization we secured data to determine when it was expedient to allow functionating of the transplanted muscle.

In the first series of operations we wished to determine, under the simplest conditions,

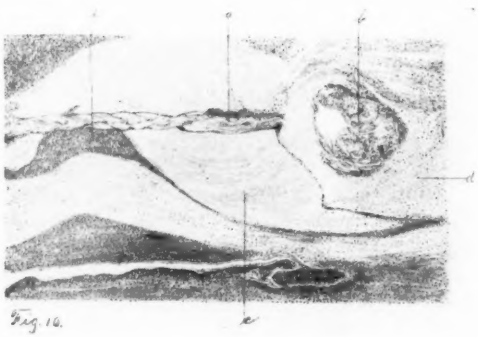


Fig. 10. Camera lucida drawing of tendon end, twelve days post-operative, illustrating the extensive necrosis of the tendon. Experiment H2. Immobilized twelve days. Objective Zeiss A2. Ocular 1. Tube 140. a, longitudinal silk strand; b, transverse silk strand; c, necrotic tendon; d, living tendon with great increase in cells; e, peritendineal cells.

the relative efficiency of various methods of preventing adhesions. Accordingly we excised one-half cm. of a tendon, either the Achilles or the extensor digitorum — in some cases simply divided the tendon, allowing a retraction of the tendon ends for one to one and one-half cms. Further retraction was prevented by uniting the tendon ends with the Lange stitch. No attempt was made to unite the tendon sheath; often, in fact, it was removed in large part, so that it could not contribute to the prevention of adhesions.

First, four control experiments were performed. (A 1, 2, 3, 4.) In A1 the leg was simply immobilized for twenty-seven days without operation. On removing the bandage the leg was freely movable. In A2 the simple tendon plastic as just described was performed on the extensor digitorum and the leg immobilized in 90° flexion for ten days. Examination then showed that it was impossible to extend the leg beyond 100°. The animal was allowed to use the leg freely for three days and the specimen then obtained. Extension had already increased to 125°. The tendon ends were adherent to the skin, sheath of the tibialis anticus and the adjacent tissues, but the adhesions were sufficiently lax to permit the tendon to functionate. The gap between the tendon ends was already bridged by a fibrous tissue, about half the thickness of the tendon, completely enveloping the silk strands. The experiment showed, first, the tendency of the tendon ends to form adhesions; second, the effect of function of the tendon in stretching these early adhesions; third, the rapid formation of a tissue uniting the tendon ends when the diastasis between them is bridged by silk strands. In A3 a similar operation was performed, and, to determine the effect of a longer fixation period, the leg fixed for thirty days. Here, immediately after removing the bandage, the leg showed only the 5°–10° of motion allowed within the celluloid splint. The animal was allowed to use the limb freely for ten days and then autopsied. Extension had become normal. Abundant adhesions were present about the site of the operation as in Experiment A2, but were so stretched as to allow perfect function. The gap between the tendon ends was completely replaced by a dense tissue, difficult to distinguish from the normal tendon. In A4, to produce another type of adhesion, the periosteum was purposely in-

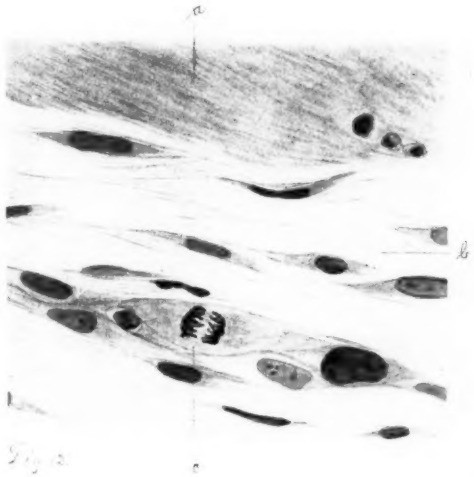


Fig. 12. Camera lucida drawing of tendon end, seven days post-operative, showing mitotic figure in a tendon-cell. Experiment L1. Immobilized seven days. Objective Zeiss, oilimmers, Ocular 8. Tube 140. a, necrotic tendon; b, living tendon; c, mitosis in a tendon-cell.

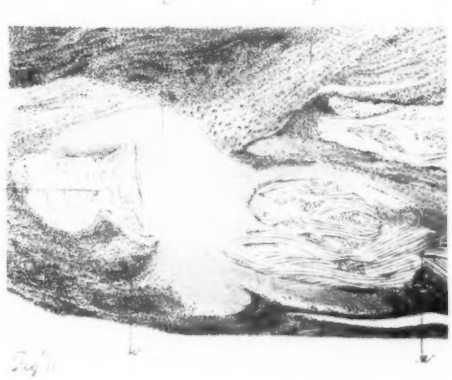


Fig. 11. Camera lucida drawing of tendon end, twenty days post-operative, illustrating the reduction in the extent of the necrosis and its limitation to the area distal to the transverse silk strand. Experiment I2. Immobilized ten days; free ten days. Objective Winkel 2. Ocular 1. Tube 140. a, longitudinal silk strand; b, transverse silk strand; c, necrotic tendon; d, living tendon with great increase in cells; e, peritendineal cells.

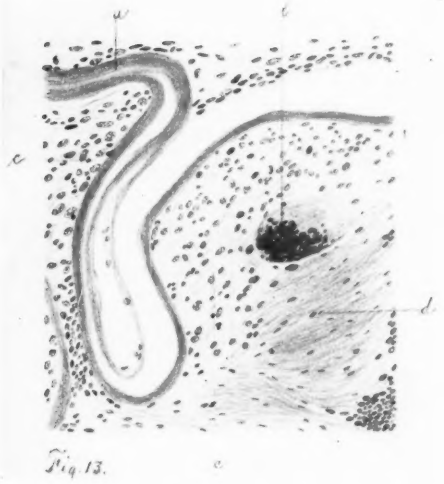


Fig. 13. Camera lucida drawing of the Cargile membrane, twenty days post-operative, showing the loose cellular nature of the tissue surrounding it. Experiment I1 Immobilized ten days; free ten days. Objective Winkel 4a. Ocular Zeiss 6. Tube 140. a, Cargile membrane; b, giant-cell; c, polyblasts, leucocytes, lymphocytes, fibroblasts; d, young connective tissue.

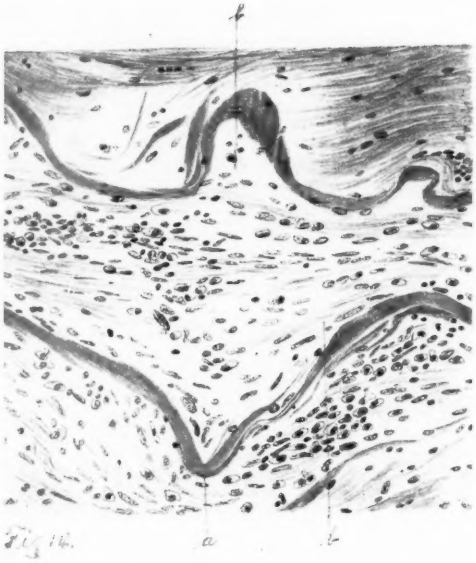


Fig. 14. Camera lucida drawing of the Cargile membrane thirty-six days post-operative, showing the increase in the amount of connective tissue since the twentieth day. Experiment H4. Immobilized fifteen days; free twenty-one days. Objective Winkel 4a. Ocular Zeiss 6. Tube 140. a, Cargile membrane; b, young connective tissue.

jured and the leg immobilized for 30 days. The resulting adhesions to the bone held the tendon ends so firmly as to absolutely prevent function.

The first means of preventing adhesions that suggested itself was the implantation of a body tissue between the operated tendon and periosteum. In view of Lange's success in preventing adhesions by running the silk strands through the subcutaneous fatty tissues, fat seemed to us the most suitable tissue. The difference in the operative conditions which exist between the human subject and the rabbit must, however, be emphasized: the rabbit has no subcutaneous fat except in the region of the groin and shoulder. Therefore no analogy can be drawn between Lange's technique and our experimental procedure. In four experiments (B 1, 2, 3, 4) a piece of fat taken from the groin of the operated animal was placed about the tendon ends and the intervening silk. The leg was immobilized and the specimens obtained after ten, eleven, thirteen, and sixty-nine days. In all four, even after ten days, dense adhesions were present, due, as the microscopical preparations showed, to the replacement of the fat by fibrous tissue.

In Experiment C a homoplastic transplanted piece of cartilage from the ear was interposed between the operated tendon and the periosteum. The leg was fixed twenty days, freed for nine days. At autopsy, dense adhesions of all the tissues near the site of the operation were found and only a slight degree of mobility present.

The lack of success attending the implantation of living tissues led us to try inorganic material. In Experiment D the tendon ends and the adjacent tissues were well covered with sterile vaseline to which, for the sake of asepsis, bismuth subnitrate had been added. The leg was immobilized for twenty-one days and then the animal allowed to use the limb freely for four months. Immediately after the fixation period the leg was immovable: even after the four months of freedom motion remained considerably restricted. Autopsy

showed in this instance, also, abundant adhesions and impaired muscle function.

Somewhat more success attended Experiment E, where the tendon and silk were enveloped in a tube of thin rolled silver. At autopsy, after thirty days' immobilization, the silver tube was adherent to the tendon and the adjacent tissues, but the adhesions to the tendon were sufficiently lax to permit a moderate degree of function. The method had the evident disadvantage of producing an unsightly, bulky prominence. Consequently we tried to overcome this objection by making the tube of two longitudinal sections, one sliding over the other, to each of which a long silk suture was attached and brought out of the upper angle of the wound. We hoped after ten days to remove the sections by traction on the sutures, but the procedure proved difficult, necessitating almost a secondary operation, and the method was, therefore, discarded.

Though the research originally planned a study of the Lange silk tendon plastic, it seemed wise, in view of our first failures, to attack the problem on a broader basis. We, therefore, substituted a strip of autoplastic fascia for the silk. Two operations were performed, both on the quadriceps tendon. In Experiment F the leg was fixed twenty-four days, freed thirty-eight days; in F2, fixed twenty-eight days, freed fourteen days. In both the function of the muscle was markedly impaired, first by dense adhesions, second by the stretching of the transplanted fascia and of the scar tissue uniting it to the quadriceps tendon.

In Experiment G we attempted a further modification by transplanting a portion of the plantaris tendon to replace the resected quadriceps tendon, and then inserting between it and the bone a strip of rabbit's vena cava, preserved in 4 per cent formalin and thoroughly washed in sterile saline before the operation. Despite the complicated procedure, the healing was perfect, but the function of the quadriceps was entirely lost by adhesions and by stretching of the transplanted tendon and scar tissue.

The successful healing in of the formalinized vein led us to try further experiments with preserved animal tissues. The most practical seemed to us the preparation of pig's bladder known as "Cargile membrane." Of this two varieties are procurable — the chromicized and the non-chromicized. We used the chromicized.

After the usual operation on the extensor digitorum, the tendon ends and the intervening silk strands were completely enveloped with a strip of the membrane, rolled so as to form an artificial sheath. The leg was fixed seven weeks, freed for two. The result was a tendon so nearly the normal in function and appearance that it was difficult to determine which leg had been operated on. Gentle traction on the muscle produced extension of the toes. No adhesions were visible, and the site of the tendon resection was macroscopically indistinguishable.

To test the efficacy of the procedure carefully, eight similar operations were performed on the extensor digitorum and Achilles tendon (H 1–8), ranging in duration from twelve to one hundred and thirteen days; the free period from none to one hundred days; the period of fixation from nine to twenty-three days. In all the animals which were allowed to run about freely for even a few days after removing the fixation bandage, the final functional result was excellent. Immediately after the fixation period, however, the legs were without exception movable to only a slight degree. In the rabbit autopsied at this stage the Cargile membrane was found adherent to the skin by a thin tissue which stripped away easily. The tendon moved backward and forward within the Cargile sheath for about 1 mm.; that is, it showed the range of motion allowed by the celluloid splint. The Cargile membrane, therefore, did not prevent adhesions. The adhesions, however, to which it gave rise, unlike those attending the implantation of the other substances tested, were of a kind which, under the simple conditions of this experiment, yielded to the contraction of a healthy muscle. The microscopical pictures evidence the comparatively loose type of tissue surrounding the membrane. A week after the operation it was closely invested with leucocytes and cells of the polyblast type (Maximow), with only a

few fibroblasts present. Gradually the fibroblasts increased in number until by the twentieth day they formed the predominant cells. By the thirty-sixth day the tissue had become distinctly more fibrous, but, even as late as sixteen weeks after operation, shreds of the membrane were in many places still unabsorbed and the tissue about it comparatively loose in character.

Too great an effect, however, should not be attributed to the membrane. It must be remembered that in control experiments A2 and A3, in which the tendon was not ensheathed with Cargile membrane, the functional results were also good. Further, the microscopical sections showed that the membrane did not form a smooth investing sheath, but one with numerous folds, some of which are seen in Fig. 14. Between these folds the tissue was frequently as dense as the surrounding connective tissue; only in the immediate proximity of the membrane did it possess the loose character above described. Owing to these complicated foldings it seems to us improbable that the line of cleavage for the motion of the tendon occurred exactly in the plane of the membrane. In fact, in two of the experiments of the next series we could prove conclusively that the motion did not take place in this plane, but that the membrane was completely enclosed by newly formed tendon, and could not, therefore, act as its sheath.

In this series (I 1, 2, 3, 4), performed as a further test for the efficacy of the Cargile membrane, it was in the first two wrapped only about the tendon ends, in the second two only about the intervening silk (Fig. 2). In these two latter the newly formed tissue uniting the tendon ends would include the Cargile membrane and, therefore, inhibit its usefulness. The microscopical examination of the specimens recovered after twenty days showed that this had actually occurred, but the functional result in rabbit I3 was fully as good as that in I1 and I2, where the membrane had been so placed as to be effective. In rabbit I4, however, the function was somewhat impaired. It is possible that this inferior result was due to the inclusion of the Cargile membrane within the newly formed tissue, whereby its effect as a sheath was lost. On the other hand, in the face of the excellent functional results secured in Experiments A2, A3 and I3 where the tendon was not ensheathed within the membrane, we are not justified in assuming the inferior result in I4 to be due to its absence. This may just as well have been due to slight errors in the operative technique — more extensive traumatization, or hæmorrhage, or less accurate insertion of the tendon stitch. We have, therefore, no convincing evidence for the efficacy of the Cargile membrane. That it does not exaggerate the tendency to adhesions, as did the transplanted tissues and the foreign bodies tested by us, is positive. That its effectiveness after six week is gradually lost and further immobilization contra-indicated is also positive. That it may help secure a good functional result if mobilization is begun before that period is possible, but the results of our experiments do not warrant us in maintaining this effect to be more than a possibility.

In the next series of experiments, at Professor Lange's suggestion, we attempted reducing the period of fixation by early faradization of the operated muscle. It is true that against this procedure speaks the experience of Seggel, Hoffa, and Borst, all of whom, after careful experimental work, advised long postoperative fixation. Still, we wished to determine whether faradization could prevent the adhesions to the bone which Lange had observed in clinical cases and which we had observed in control Experiment A4, where we had purposely injured the periosteum. In two instances, therefore, after the usual operation on the extensor and flexor digitorum respectively, in both of which the periosteum was purposely traumatized, the rabbits were given daily faradization. In both animals the results were the same. At first the rabbits' claws responded briskly to the stimulation by movements of extension or flexion, but gradually the response diminished until eventually, even with a strong current, the claws could not be made to move. Autopsy of both rabbits showed dense adhesions to the periosteum. A third experiment (J3), in which care was taken not to injure the periosteum, was then performed to determine whether faradization

could prevent such adhesions as noted in control Experiment A_3. Stimulation was begun the third day after operation. For the first five days all the claws responded vigorously. Thereafter, though the muscle could be felt to contract, the claws responded but slightly to a very strong current and after a few days failed to respond at all. Faradization was continued daily for twenty days; then the rabbit was autopsied. The silk was found entirely torn out of the distal stump of the tendon, allowing a diastasis of 3 cm. between the tendon ends. This gap was filled with scar tissue which bound down the distal end of the tendon, but there was no strong bridge uniting the tendon stumps. Consequently traction on the proximal portion produced no motion of the distal. This tearing out of the silk corresponds with similar observations in subsequent experiments where early mobilization was attempted, and with the microscopical evidence of extensive necrosis of the operated tendon.

The final series of our preliminary experiments gave unqualifiedly the best results. The method was suggested by Biesalski in an article on "The Exchange of Tendon Sheaths." In several cases of anterior poliomyelitis he withdrew the paralyzed tendon from its sheath and brought the substituting tendon down through this sheath to its new insertion. We tried the same method, using the Lange silk tendon, so as to test the value of the method in those cases in which the transplanted tendon proved to be too short. To make the operative conditions the simplest possible, we used only one muscle for the entire procedure — the tibialis anticus.

The sheath was opened near the insertion of the tendon, a long suture passed through the tendon, the tendon severed distal to the suture and drawn through a second incision made over the muscle belly. As the tendon was withdrawn a portion of the silk was pulled up through the sheath with it. There is in reality no true tendon sheath here in the strict sense of the word. There is instead a fascial compartment in which the tendon glides freely corresponding exactly to the fascial compartment in which the human tendo Achillis runs. Though the tendo Achillis possesses no true tendon sheath (Spalteholz), the fascial compartment is so nearly its functional equivalent that the term "tendovaginitis" applied to the Achilles tendon is in general good usage. We shall consider these fascial compartments of the rabbit as the equivalents of the tendon sheaths and hereafter not attempt to differentiate between the two. Three or four centimeters of the tendon were resected, the remaining stump threaded by Lange's method, and, by traction on the distal end of the suture, the tendon pulled within the sheath. The distal end of the suture was then fastened near the original insertion. We thus had substituted a silk suture for the distal 3–4 cm. of the tendon and run the silk through the sheath of the tendon.

Six operations were performed of from eight to forty-four days' duration (K 1–6). In three animals the specimens were obtained immediately after the fixation period at eight, thirteen, and twenty-nine days respectively. The other rabbits were given eight to thirty-six days of freedom after one to two weeks' fixation. In all the animals, whether immobilized or free, the results were the same: perfect function was secured. Even after twenty-nine days' fixation the operated tendon moved within the sheath as freely as the normal. Microscopical preparations showed this to be due to the preservation of the normal space between the tendon and the sheath.

All the experiments thus far cited constitute a preliminary series. They were performed under the simplest operative conditions, more nearly analogous to those of a transverse tenotomy than to those of a complicated human tendon plastic. The muscle and tendon were left *in situ;* therefore, the adhesions occurring during the process of healing were likely to be stretched by the normal motions of the animal. The experiments showed, first, that adhesions under these conditions could be entirely prevented by running the artificial tendon through the tendon sheath; second, that in the absence of periosteal irritation the healthy muscle could, unaided, overcome the adhesions to its tendon; third, that autoplastic transplants, preserved animal tissues, or foreign bodies, introduced as an

artificial sheath, tended, with the exception of Cargile membrane, to exaggerate rather than to inhibit the adhesions. The Cargile membrane, however, possessed only a questionable value whose period of possible usefulness did not extend beyond five or six weeks.

It now remained to study the changes occurring after transplants more nearly analogous to those in the human and to determine whether the facts learned in the preliminary experiments could be applied to these more complicated conditions.

In Experiments L1–10 a muscle of the rabbit's mesial group—either the extensor hallucis or flexor digitorum—was threaded as in the typical Lange operation and divided distal to the suture. Through a second incision over the external surface of the tarsus the silk threads and the proximal portion of the tendon were drawn through the subcutaneous tissues and fastened near the insertion of the peroneus. Ten experiments were performed ranging in duration from seven to fifty-nine days: the fixation period from seven to thirty days, the free period from none to twenty-nine days. The technique of the operation was by no means simple; in the first place, the tendons were small—only three-fourths mm.—in diameter, and difficult to hold with the suture; in the second place, they rested directly against the periosteum of the tibia, so that an injury to it was sometimes unavoidable. Yet these difficulties were in a way advantages, since they were exactly those difficulties, exaggerated, which confront the surgeon in the human operation. Our failures, therefore, illustrated the errors which must be avoided in performing a tendon plastic. In four cases the silk tore out of the tendon. The microscopical examination showed that this was probably due to the extensive necrosis of the tendon produced by the stitch (Fig. 10). If the silk does not tear out entirely it may slip downward in the tendon to such a degree as to lose the necessary tension. This happened in a fifth experiment where at autopsy the silk was found so lax that strong traction on the muscle could not make it tense. Of course in the human where the tendon is larger and the longitudinal stitches can be taken in several planes, the danger of tearing out is distinctly less; still, no one can have performed many silk tendon plastics without noting the tendency of the sutures to slacken. This tendency to necrosis constitutes the all-important reason against early functioning of the operated tendon after the Lange silk-tendon plastic; also, as already mentioned, against faradization as a means of preventing adhesions. A sufficiently long time must elapse after the Lange operation for the tendon to recover from the trauma it suffered, so that its cells — the tendon-cells proper and those of the peritendinium—will be enabled to reduce the necrosis to a minimum. A certain amount of slipping is from the nature of the operation inevitable, to allow for which the operated limb must be fixed in extreme over-correction. The fixation should last five to six weeks; by that time the reparative power of the tendon has reduced the area of necrosis to a negligible amount.

The second important fact taught by this series of experiments is that adhesions, after the Lange operation, occur not to the silk, as had been previously supposed, but to the tendon end. In all ten experiments the silk was found to be freely movable in its long axis and from side to side, even when it ran directly over the periosteum, whereas adhesions, more or less firm, were constantly present to the tendon end. The adhesions were absolutely fast in two cases where, owing to injury to the periosteum, a small bony tubercle had formed in which the tendon was caught. They were most lax, allowing 3 mm. of motion of the tendon end, in one instance where an unusually vigorous animal was allowed to use the leg freely for twenty-four days. These facts correspond with those noted in the preliminary experiments, where it was shown that a powerful muscle could stretch some adhesions, but adhesions produced by periosteal irritation would not yield.

The final experiments had to determine whether the adhesions to the tendon end after a typical transplantation could be prevented or their danger lessened, either by enveloping the tendon with Cargile membrane or running it through the tendon sheath.

In Experiments M1–5 a muscle of the mesial group was again transplanted as in Experiments L and the tendon end sheathed with Cargile membrane. Three experiments were performed of five, ten and thirteen days' duration with complete fixation till autopsy, and then an additional two in which, following Biesalski's suggestion, fish bladder was used instead of the Cargile membrane. In the first Cargile experiment the periosteum was injured and the tendon end was found firmly adherent after only five days; in the second and third the membrane was only loosely adherent to the tendon and adjacent tissues and 3–5 mm. of motion was noted. The movement took place partly by a gliding of the tendon end within the Cargile sheath, partly by a gliding of the Cargile membrane on the surrounding tissues. In the first fish bladder experiment the result corresponded with that noted when the Cargile membrane was used. In the second, however, after thirty-four days the tendon end was found embedded in dense adhesions. It is possible that this result was due to the inferiority of the fish bladder to the chromicized Cargile membrane, but this conclusion is by no means certain, since in the corresponding experiments in which the Cargile membrane was used (M1–2–3) the period of immobilization was much shorter. The close resemblance between the two membranes, however, gives ground for skepticism as to the value of the Cargile membrane had it been used here instead of the fish bladder, and confirms the conclusion deduced from the preliminary experiments that the membrane has only a questionable efficacy in preventing adhesions.[1]

In the final series of experiments (N1–3) the tibialis anticus tendon and the silk prolongation were run through the sheath of the peronei. The duration of the experiments was three, six and fourteen days. Unfortunately, this series is incomplete since in a fourth experiment of forty days' fixation, the silk was found at autopsy torn out of the tendon and the tendon end retracted. In this instance the tendon was embedded in adhesions. In the three experiments in which the tendon sutures held, the results corresponded with those in the preliminary series of experiments (K1–6). Within the peroneal sheath the transplanted tendon and the silk strands were entirely free from adhesions and showed the normal range of motion. Adhesions were, however, present to the tendon in its course from the normal situation to the sheath of the peronei. This was best seen in the unsuccessful experiment of forty days' duration, where the tendon end had retracted out of the sheath and was held fast by adhesions. The freedom from adhesions to the tendon within the sheath stands out as the essential fact of our research study. To prevent adhesions in tendon plastics, restore the normal relationship of the tendon to its sheath.

Technique. A slit was made in the sheath of the peronei just distal to the external malleolus, a suture passed through the tendons, the tendons divided distal to the suture, withdrawn with the attached silk through a second incision over the proximal end, and amputated. The tendon of the tibialis anticus was freed, threaded with the suture, drawn down into the sheath of the peronei and anchored by the distal end of the suture.

In addition to a study of adhesions and their prevention, the research purposed a consideration of several other points at issue. The first of these is the nature and mode of development of the tissue surrounding the silk strands. The silk strands and the blood-clot adherent to them are at first invested by leucocytes, lymphocytes, and cells corresponding to the type termed "polyblasts" by Maximow. These cells are also known as lymphocytoid cells, or "wanderzellen." As the name "polyblast" implies, they show many varieties of form: circular or polygonal (in section), regular in outline, or with numerous processes. Their origin is still a problem of debate — whether they are derived from the lymphocytes or from the fixed connective-tissue cells or both. Mingled with them are a gradually increasing number of fibroblasts. The number of leucocytes varies markedly, depending probably upon the grade of asepsis; in some preparations they were present to the exclusion of all other cells; in other preparations they were the exceptional cell

[1] The fish bladder was prepared according to Biesalski's method by forty-eight hours' immersion in formalin, ten to twenty minutes boiling, and preservation in 96 per cent alcohol.

type. By the thirteenth day the fibroblasts are the dominant cells; together with a smaller number of polyblasts and leucocytes they form a layer immediately surrounding the silk. External to this lies a zone of dense fibrous tissue similar to young tendon tissue, varying in width, but in the average twice as broad as the cellular zone. It is composed of long pale-staining cells, lying in a dense fibrillar matrix. Almost all the cells and fibers run parallel to the silk strands, but in cross sections a number can be seen encircling the silk. It is equally well developed in the experiments where the silk strands were run through the sheath and in those where they ran subcutaneously. Though it is somewhat better developed near the tendon stump than in the distal portion, there is not sufficient difference in the grade of development to justify the theory that it is derived entirely from the tendon. The tendon undoubtedly contributes to its formation, for the tendon-cells show active proliferation as evidenced by numerous mitoses, and can be seen growing in long sheaves into the primary loose cellular tissue (Fig. 6). In one specimen, owing to severe trauma and slight infection, the tendon-cells even after two weeks showed little reaction, but this dense, tendon-like tissue was no less well developed (Fig. 5.) In another, where the silk had been run into the muscle, it was well developed about the intramuscular strands. We must, therefore, assume that it is formed in great part by connective-tissue cells which assume the characteristics of tendon-cells and arrange themselves in long parallel columns.

In the further process of growth the tendon-like tissue becomes more fibrous and less cellular, and gradually enlarges centripetally at the expense of the loose tissue immediately surrounding the silk, and centrifugally at the expense of the tissues external to it. By the thirtieth day (Fig. 7) it resembles young tendon tissue closely but can be distinguished from it by the length of the nuclei, the true tendon-cells and nuclei being longer; second, by the texture of the fibers. True tendon even when young has a peculiar shimmer not acquired by connective tissue. There are indeed places where these criteria fail. These are usually situated near the stump of the operated tendon where the new-formed tissue is composed partly of tendon-cells, partly of connective-tissue cells, and, therefore, partakes of the character of both tissues.

For this peculiar type of connective tissue we must assume the traction on the silk to be responsible. A strand of silk not subjected to such traction—an ordinary ligature, for example:— is enveloped by a loose connective tissue in which the fibers run in all directions. In those instances where the silk was for a time subjected to traction, but later tore out of the tendon, we found many fibers running parallel to the silk, but their degree of development was distinctly less than in those cases where the artificial tendon functioned. Levy also, in the ingenious experiment already referred to, where, after tenotomy and excision of a portion of the muscle, an artificial line of traction was introduced between the tendon ends at right angles to the normal, demonstrated conclusively the effect of traction in causing an alignment of the connective-tissue fibers parallel to the line of traction. We have, therefore, every reason to believe that the pseudotendinous structure enveloping the silk is due to its functionating as tendon. It must, however, be emphasized that the growth of this tissue, though rapid during the first few weeks, is subsequently slow; that even after forty-four days the amount of pseudo-tendon is little greater than after twenty days, and that it is then far from being sufficiently strong to withstand the tension to which the normal tendon is subjected. The silk must, therefore, be of sufficient tensile strength to act as an effective substitute for the tendon. Several of our experiments could not be included among those herein described, since we failed to realize the importance of this fact and used silk of insufficient tensile strength which snapped even before mobilization of the tendon was attempted.

The final question which our research attempted to answer was a determination of the period of post-operative fixation. To this we have already referred. Here two conflicting factors must be considered: first, the danger of the silk tearing out of the tendon; second, the danger of adhesions. Evidently the longer

the fixation, the less the former danger, the greater the latter. A mean, therefore, has to be found between the two.

The trauma of the operation produces an extensive necrosis of the tendon. This is most marked in that portion included by the silk strands but is also present external to the silk (Fig. 10). In a few instances the necrotic area was invaded by leucocytes, but as a rule it was not — an indication that, as Borst already suggested, we are dealing with a variety of bland necrosis. To restore the injury, an intense proliferation of the true tendon cells and of the cells of the peritendinium internum takes place. In specimens of seven, ten, and fourteen days, however, the necrosis is still very extensive. This necrosis cannot be considered an absolute argument against mobilization of the tendon, but only as a relative factor. In almost all the experiments of the first series, where after tenectomy the tendon ends were joined by silk strands, early mobilization did not cause the silk to tear out. It must be remembered, however, that under these conditions the tendon ends are rapidly united by young tendon and connective tissue which relieves the strain on the silk. The conditions in a silk plastic operation are quite different. Still, even in the true plastics, the silk held in a number of experiments despite removal of the fixation bandage ten days after the operation (Fig. 9). Moreover, in two silk tendon plastics where we had a chance to test the security of the tendon stitch during the first fourteen days, it showed surprising strength, withstanding a strain of one and one-half kilos. In six experiments where early mobilization was also attempted, the silk tore out or became lax. It also tore out in four experiments despite the fixation, owing to undue tension which had been put upon it. We must, therefore, decide, despite the favorable results seen in some instances of early mobilization, that it is wiser not to risk tension on the silk during the period of extensive necrosis.

The repair of the necrosis takes place first in that portion of the tendon external to the silk strands, and last of all in that portion lying directly distal to the transverse stitch. It is an unfortunate fact that the portion of the stitch which has the firmest hold on the tendon — the transverse strand — produces the most lasting necrosis. Where the tension is greatest, just distal to the transverse strand, the necrosis persists the longest. Here it can be seen in all the specimens of twenty days' duration (Fig. 2).

After thirty-six days, though it is still present in this situation, it has been reduced to a negligible amount by the ingrowth of the surrounding tendon and peritendineal cells, whose activity is indicated by frequent mitotic figures. Our study of the necrosis produced by threading the stitch through the tendon brought us to the conclusion that, though early mobilization of the tendon after the Lange operation may give good results in some instances, it is wise to give the tendon ample opportunity for repair by keeping it at rest five to six weeks.

We must be cautious in applying these experimental observations to surgical practice. Most of the human tendon plastics are performed for paralyses due to anterior poliomyelitis, in patients whose trophic neurones, as well as the motor, have suffered more or less degeneration. We must, therefore, in determining the period of post-operative fixation for the human, vary it according to the degree of trophic disturbance evidenced in each individual instance. The discrepancy between the rabbit and the human patient is even more marked when we consider the other factor of post-operative fixation — the tendency to adhesions. Certain facts undoubtedly hold good for both experimental animal and human being: that adhesions can be prevented by restoring the normal relationship between tendon and sheath, and that all artificial methods of constructing or replacing the sheath by implanting tissues or foreign bodies defeat their own ends. In our animal experiments it was impossible to test accurately the effectiveness of Lange's method of preventing adhesions by drawing the tendon and silk through the subcutaneous fatty tissues, since the rabbit possesses practically no subcutaneous fat. We are therefore unable from our data to determine how long fixation should be maintained after a silk-tendon plastic upon the human patient.

SUMMARY

Our experimental study of the Lange silk-tendon plastic indicates that the one effective method of preventing post-operative adhesions consists in a restoration of the normal anatomical relations of the transplanted tendon to its environment. This is best done by Biesalski's method of running the transplanted tendon through the sheath of the paralyzed. All artificial methods of preventing adhesions by implanting living tissues or interposing foreign bodies defeat their own ends, since they exaggerate rather than inhibit the tendency to adhesions. The one possible exception is Cargile membrane. This may, for five or six weeks, help slightly to prevent dense adhesions, but the results of our experiments do not warrant us in maintaining this effect to be more than a possibility.

The adhesions after the Lange operation occur not to the silk but to the end of the transplanted muscle or tendon. The tendon itself, subsequent to the operation, shows extensive necrosis, from which, however, it recovers in from five to six weeks. During this period it should be kept at rest, and undue strain or tension on the silk strands should be avoided.

The tissue enveloping the silk strands consists of a dense fibrous tissue, almost all of whose fibers and cells run parallel to the long axis of the silk; a smaller number encircle the silk. It is developed essentially from the adjacent connective tissue, though the true tendon-cells and the cells of the peritendinium and tendon sheath also contribute to its formation. The arrangement of its fibers and the degree of its development depend upon the functional demands to which it is subjected. Anatomically, it is not tendon. It must be emphasized that its development, though rapid during the first few weeks, is subsequently slow. The major share of the tension must for a long time be borne by the silk strands. Therefore, they must be of sufficient tensile strength. Therefore there is also necessity of long post-operative fixation, allowing the tendon to recover from the necrosis subsequent to the operation and insuring a firm union between the silk strands and the stump of the transplanted tendon.

The research was performed in the surgical laboratory of the Königliche Orthopädische Universität's Poliklinik, München, Professor Fritz Lange, and in the Königliche Pathologische Institut der Universität München—director, Professor Max Borst.

We wish to acknowledge our great indebtedness to Professor Lange for suggesting this research, for placing all the facilities of his surgical laboratory at our disposal, and for his constant interest and advice; and to Professor Borst for our courteous reception in the Pathological Institute and his confirmation of our microscopical findings.

LITERATURE

BIESALSKI. Deutsche med. Wchnschr., 1910, No. 35.
BORST. Ziegler's Beitr. z. pathol. Anat., 1903, xxiv.
ENDERLEN. Arch. f. klin. Chir., 1893, xlvi.
HOFFA. (a) Verhandlungen d. Gesellschaft deutscher Naturforscher und Ärzte, 1901. 73 Versammlung zu Hamburg. (b) München. med. Wchnschr., 1901, No. 51.
LANGE. (a) Ergebnisse f. Chirurgie u. Orthopadie, 1911, Vol. II. (b) Verhandlungen d. Gesellschaft deutscher Naturforscher und Ärzte, 1901. (c) München. med. Wchnschr., 1902, No. 1.
LEVY. Arch. f. Entwicklungsmechanik d. Organismen, 1904, xviii.
MARCHAND. "Prozess der Wundheilung," Stuttgart, 1901. (Complete literature on healing of tendon wounds.)
MAXIMOW. Ziegler's Beitr. z. pathol. Anat. 5 Supplement Heft, 1902.
RICHARDSON. Boston M. & S. J., 1911, May 25.
SCHRADICK. "Untersuchungen an Muskel und Sehne nach der Tenotomie." Inaug. Diss., Rostock, 1900.
SEGGEL. Beitr. z. klin. Chir., 1903, xxxvii.
SEVER. Boston M. & S. J., 1911, May 25.

ON THE PATHOLOGY AND TREATMENT OF CHRONIC LEUCORRHŒA[1]

A Study of the Causes of Purulent Vaginal Discharges and the Results of Various Kinds of Treatment

By ARTHUR H. CURTIS, M. D., Chicago

From the Memorial Institute for Infectious Diseases; Aided by a Grant from the Fenger Memorial Fund

THE study of chronic leucorrhœa was undertaken chiefly because so much concerning the subject has remained a mystery. In the two years devoted to the work, a liberal amount of dispensary material, added to unusual opportunities for the study of private patients, has made it possible to follow a considerable number of cases. Eighty-five of these have been subjected to thorough bacteriological study.

Types of patients in which purulent discharges occur. The vast majority of cases of chronic purulent vaginal discharge in women who have not been pregnant are consequent to gonococcal infection. Such, at least, is the evidence from observation of dispensary and private patients made with the special object of determining this point. In virgins and other nullipara whose history and local findings exclude suspicion of specific infection, discharges other than those of a mucous nature are not usual; when found in these cases free from veneral disease, mucous secretion is usually associated.

In women who have borne children additional factors which appear to lead to purulent leucorrhœa are infections associated with pregnancy, altered anatomical relationships consequent to labor, loss of elasticity of tissues, and increased mucus. (A consideration of cancer is scarcely within the scope of this paper and is purposely omitted.)

Place of formation of discharges. To decide whether uterine infection exists in cases with chronic discharge, the cervix has been regularly exposed to view and observed; it has also often been dilated to assure free drainage during the period of observation. Cultures were made from the uterus obtained at operation in several instances, and likewise from scrapings from a dozen patients with leucorrhœa. The net results have been a failure of almost all attempts to discover a purulent discharge from the uterus, and negative findings in the smears and cultures. It therefore appears that purulent discharges are formed in the lower genital tract and rarely consist of bacteria-laden material from the uterine cavity. It must at the same time be remembered, however, that mucus comes from the cervix and that this mucus may form culture material for vaginal bacteria.

BACTERIOLOGY OF LEUCORRHŒA

The results of a study of the bacteriology of leucorrhœa have been reported[2] as a preliminary to the present contribution. A consideration of findings as there recorded and of recent results obtained is desirable before entering upon a discussion of treatment.

Secretions from the uncontaminated vagina, i. e., secretions from children and from women who have not had intercourse, also those from a surprisingly large number of married women, contain almost exclusively the large gram-positive vaginal bacilli of Döderlein (Fig. 1). The other extreme is represented by the bacteria found in profuse leucorrhœal discharges (Fig. 2). In an intermediate group belong the secretions from most married women; these present a gradation from normal to leucorrhœal bacterial content, the organisms present in each instance depending upon the amount and character of the vaginal flow.

I have succeeded in isolating and determining the cultural characteristics of a considerable number of bacteria common to leucorrhœa. Many of these are already well known. Others, notably anaërobes, have not been previously described. A detailed discussion of most of these various organisms is included in the former report.

[2] On the Etiology and Bacteriology of Leucorrhœa, Surg., Gynec. & Obst., 1914, xviii, 299.

[1] Inaugural thesis before the American Gynecological Society, Boston, May 19, 1914.

Characteristic of smears and cultures from leucorrhœal discharges is the preponderance of anaërobic bacilli. Cultures from the external genitalia in contrast with higher vaginal cultures contain more aërobes, notably bacillus coli, staphylococci, and pseudodiphtheria bacilli. Consequently, high vaginal cultures from patients who are subjected to frequent douching show contamination with these bacteria, but in true vaginal cultures certain types of anaërobic bacilli are predominant.

Gram-positive diplococci are always present in vaginal smears. Often they are in considerable numbers but are not found in groups or chains. Streptococci are infrequent in fresh preparations but readily develop from diplococci on artificial media. Staphylococci are found in the vaginal smears but are notable chiefly for their moderate number. It is also doubtful whether bacilli of the colon group actively participate in the production of leucorrhœa. The part played by pseudodiphtheria bacilli requires further study.

Gonococcus. In smears made from vaginal pus the gonococcus resists positive identification. It can be differentiated from other forms only if found in considerable numbers and in typical arrangement. From its favorite locations, however, it is obtained frequently enough to reveal its enormous importance as the primary cause of subsequent chronic leucorrhœa. After creating conditions favorable for the development of other organisms which are associated with chronic purulent discharge, in a considerable percentage of cases the gonococcus disappears, or at least is not demonstrable through any means at our command. This suggests that a chief part played by the gonococcus in chronic leucorrhœa consists in preparing the soil for the leucorrhœa-producing anaërobic bacteria.

TREATMENT: INTRODUCTORY

As preliminary to the subject of treatment, some features of importance in the foregoing may be summarized for sake of emphasis:

1. The uterine cavity tends to remain free from bacteria in cases of leucorrhœal infection.

2. Excessive mucus secreted from the cervix not only increases the total amount of vaginal discharge but at the same time is culture material for bacteria which produce purulent discharges.

3. The usual seat of formation of purulent discharges is the lower genital tract (lower cervix, vagina, and vulva).

4. In the vast majority of cases the picture is one of decreased local vitality with associated low-grade infection. The organisms present are chiefly anaërobes, notably anaërobic bacilli. Often aided by increased mucous secretion, these apparently mildly virulent bacteria lodge and develop. There is reason to believe that they play an active part in the production and maintenance of leucorrhœa, until through treatment or increased local resistance their further growth is prevented.

INDICATIONS FOR TREATMENT

Indications formulated from a study of the causes and of the bacteriology of leucorrhœa, aided by experience with treatment of various kinds, are as follows:

1. Improvement of the lowered resistance of the genitalia.

2. Avoidance of treatment which is not indicated and which may do harm.

3. Arrest of excessive mucous secretion from the cervix.

4. Treatment directed against residual gonococci or lesions resultant from gonorrhœa.

5. Employment of special curative measures; i. e., vaccines, powder treatment, etc.

Improvement of lowered resistance of the genitalia. Assuming we have to do with a loss of local balance, with vitality not sufficient to cope with weakly pathogenic bacteria, detailed attention to causes of lowered resistance is indicated. Systemic disorders require watchfulness; the bowels must be free; complicating displacements, tumors, pus-tubes, and the like must be cared for.

Lacerations incident to childbirth are particularly objectionable; gaping of the vulva invites contamination; congestion of torn tissues promotes the transudation of serum in which bacteria may develop, and in folds of relaxed mucous membrane secretions accumulate and form pockets of purulent material. These lesions may be of such a

Fig. 1.

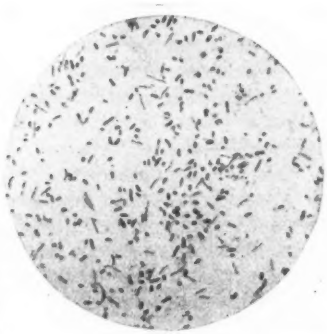


Fig. 2.

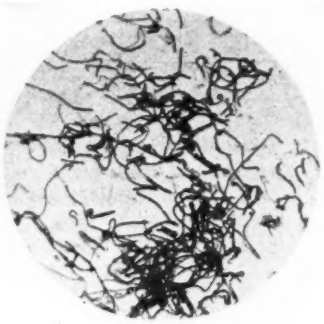


Fig. 3.

Fig. 1. Döderlein bacilli in smear from normal vagina. A usual picture in smears from non-infected nulliparous women.

Fig. 2. Leucorrhœal discharge, gram stain. Gram-positive diplococci are usually about as numerous as seen here. Note preponderance of gram-negative (lightly stained) over gram-positive bacilli.

Fig. 3. Culture of bacillus of lactic acid group in symbiosis with a gram-negative fusiform bacillus. Used for vaccine with good result. Carbogentian violet.

character that a plastic operation is needed before recovery can occur.

AVOIDANCE OF TREATMENT WHICH IS NOT INDICATED

Treatment of the uterine cavity. Granted that the uterus is commonly free from bacteria, as seems true from my experience, treatment of the uterine cavity is not indicated. If infection of the endometrium does exist, harrowing the soil through use of the curette may tend to increase rather than diminish infection; in such cases we would oppose anything more than dilatation for drainage, possibly aided by iodine or other topical applications.

Douches. The use of douches appears to be ill-advised. Just as irrigation of the peritoneal cavity and of other infected surfaces has been found to be irrational, so douches scatter bacteria broadcast and fail to thoroughly remove the source of infection. In my experience douches have yielded poor results.

Tampons. These require only passing mention, as they have been quite generally discontinued. There seems little more indication for vaginal tampons than for the use of glycerine-ichthyol soaked cotton packing in deep wounds of the body surface.

Excessive mucous secretion from the cervix. Mucus plays a big rôle in leucorrhœa production; when it is present in excess the cervix requires attention. Operation with excision of excessive glandular tissue would be the method of choice did it not require anæsthesia. Scarification, advocated by Hunner, may be employed. The use of powder will be mentioned later. Repeated cauterization with 20 per cent silver nitrate destroys mucous glands, gradually enlarges the cervical canal and is excellent for destruction of deep-lying gonococci; this has been employed in a number of extreme cases with gratifying results.

TREATMENT DIRECTED AGAINST RESIDUAL GONOCOCCI OR SPECIAL TISSUE CHANGES RESULTANT FROM GONORRHŒA

Deeply buried infection of the urethra and granulations of the urethra react favorably to applications of silver nitrate. Long-standing infection of Skene's ducts or of the periurethral glands may be treated by cauterization with 20 per cent silver nitrate; recourse to excision may be had as a last resort. Chronically infected bartholinian glands require removal. Treatment of the cervix is similar to that for excessive mucous secretion.

VACCINE THERAPY

The views of many leaders in medical thought are at variance concerning the value of vaccine therapy even in infections with a

single organism. This is an indication of the difficulties met with in formulating conclusions concerning the value of vaccines when many bacteria are present. To avoid bias in favor of bacterial therapy from results in cases which might have recovered spontaneously, vaccines have been used only in long-standing cases with free discharge.

Variety of vaccines used. Fresh smears are examined to ascertain whether any organism is predominant. Such being the case, that organism has been selected. Unusual forms, when prevalent, have likewise been grown for vaccine. Because streptococci are known to play an essential part in infectious processes, these have been employed for vaccines when streptococcus colonies have been numerous in cultures.

Anaërobic cultures yield an elevated, roughly beaded, rich growth, whereas control aërobic cultures commonly develop poorly in comparison. Large numbers of anaërobic tubes have been inoculated directly from the patient, the series opened at the time of well-developed growth, and those selected for vaccine which most nearly correspond with the vaginal flora as seen in fresh discharge. The slow development of many anaërobes suggested the advisability of use of mature cultures as well as of younger growths; vaccines have, therefore, also been made from growths three or more days old.

Sometimes from one or two original anaërobic cultures a set of subcultures has been made for vaccines. With this subculture method there is a tendency to overgrowth of types originally not numerous, with disappearance of many bacteria which are abundant in vaginal smears. Hence, there is objection to this technique.

Administration of vaccines. Despite the low virulence of these bacteria, demonstrated by injection of animals with fresh discharges and with cultures, it has been deemed best to begin with moderate doses. An initial injection of 10 or 20 millions is succeeded every second or third day by rapidly increased doses, until 150 to 300 millions are given at one time. Thereafter, treatment occurs every fourth to sixth day, with the amount increased or diminished as indicated.

Results. Many patients apparently cured suffer from recurrence at a later date. An instance of this is shown by a patient who, for six years, had undergone, without improvement, every known treatment for a very profuse creamy discharge. A course of vaccines resulted in complete cessation of leucorrhœal flow. Treatments were discontinued and conditions remained satisfactory for two months. Discharge then slowly returned and became gradually more profuse despite renewed use of vaccines, which thereafter were without favorable influence.

A considerable number have shown decided decrease in discharge while under treatment without attainment of the point of absolute cure. With cessation of treatment such patients tend to gradually return to their original condition; a few are permanently improved.

A fair percentage of patients are cured. A statement of the number of cures thus far obtained is omitted because experience leads us to believe that our present statistics indicate more favorable results than we will be able to secure with a larger series of cases.

A most encouraging feature has been the relief of backache and general *malaise.* Backache, which is a most frequent symptom, when not attributable to other causes is greatly relieved through vaccine treatment. The temporary increase in distress after rather large injections, also the return of backache sometimes with cessation of vaccines, indicates an intimate causal relationship between discharge and backache, and allays the suspicion that cure is attributable to psychic influences.

Vaccines prepared from selected anaërobic cultures have had the most favorable influence upon discharges. Anaërobic streptococcus vaccination was followed by disappearance of diplococci in only one case. Staphylococci caused no improvement. An autogenous vaccine prepared from a bacillus of the lactic acid group combined with a gram-negative fusiform bacillus (Fig. 3) helped one case. Other isolated strains produced no noteworthy results.

As an aid to vaccines, dry cleansing of the vagina and vulva has been used considerably.

Some most refractory cases have been swabbed with iodine and treated with suppositories containing various remedial agents.

Powder Treatment. Powder treatment of various kinds, employed by Abraham, Albert, Kehrer, Liepmann, Nassauer, and many others with reputed excellent results, has been given a thorough trial. That no essential detail might be overlooked, freshly prepared packages were secured direct from the manufacturers who supply the advocates of this method. Patients have been most punctual in appearing for treatment and applications have been made with especial care.

The various powder and yeast preparations which are recommended in the literature include the following:

1. Sterilized aluminum acetate powder.
2. Aluminum acetate, 1 part
   Kaolin, 2 parts
   Powdered talcum, 2 parts
3. Lenicet bolus with peroxide—
   Peroxide, 5 per cent
   Polimerized aluminum acetate, 20 per cent
   White aluminum acetate, 75 per cent
4. Same as (3) with silver acetate instead of peroxide.
5. Same as (3) with 1 per cent iodine instead of peroxide.
6. Injection of 10 to 20 ccm. thick fluid made from solution of brewer's yeast. Repeat every two or three days, using tampon to retain solution.
7. Xerase powder. Compound of —
   (1) Dried upper ferment beer yeast
   (2) Sugar
   (3) Aluminum acetate
   (4) Salts, viz. magnesium sulphate, sodium phosphate, sodium carbonate, calcium carbonate.
8. Sterile compressed yeast:
   4 grams sterile yeast, plus 20 cm. sugar solution injected vaginally and held with tampon.
9. "Tryon" powder; An aromatic organic iodine preparation: a soluble powder. Used in 10 to 20 per cent concentration in powder mixture or incorporated in gauze.
10. "Fermentin Vaginal Tabletten" in packages of twelve, each 1 gram. Retain with tampon twelve hours.

At the time of treatment the cervix and vagina have been exposed and carefully dry cleaned. Enough powder to form a thorough yet thin coating (one dram or more) has then been introduced and painstakingly applied throughout. Early cases were given a douche at the end of twenty-four hours, but it has been found more satisfactory to remove the powder through dry cleansing. Treatment is ordinarily given every day for a few days, then every second day, and thereafter at still less frequent intervals. Variations in the method of procedure are required according to the needs of individual cases.

Temporary improvement has been the rule. During the course of treatment irritation and inflammation have disappeared, secretion has been absorbed by the powder, the patients have felt well. Erosions heal with the cessation of vaginal secretion and thereby mucus is decreased.

Yet despite the favorable outlook, even with treatment extended beyond the prescribed period, there is a tendency to recurrence. Acute cases are started on the high-road to recovery. Through temporary relief from irritation even some that are chronic go on to cure, but a great proportion slip back into their original condition. This is true despite the addition of yeast, silver nitrate, peroxide, or other ingredients.

DEDUCTIONS

1. Care of the general health, free elimination, and treatment of pelvic complications which predispose to mild local infection must not be overlooked in the care of chronic leucorrhœa.

2. Bacteriological examinations indicate that treatment of the endometrium can ordinarily be dispensed with. In unusual cases dilatation for drainage, possibly aided by topical applications, is logical treatment.

3. Curettement of the uterine cavity, douches, and tampons are probably harmful.

4. Glands of the cervix which produce excessive mucous secretion should be excised, destroyed by cautery, or otherwise rendered inactive.

5. Purulent discharges originate as a rule in the lower genital tract. Bacteria of low pathogenicity, chiefly anaërobes, evidently play an active part in their production.

Autogenous vaccines decrease general *malaise* and backache. When aided by correction of associated pathology their influence

upon chronic purulent discharges is beneficial; a large number of patients are helped only so long as vaccines continue to be administered; a smaller number are permanently improved, and a fair percentage appear to be cured.

6. Powder treatment exerts a favorable influence but in our experience has a limited value only. Yeast seems not to have distinct advantages over other forms of powder treatment. The medicinal effects of ingredients of the powder are probably secondary to benefits from its absorptive action. Irritating discharges are absorbed by the powder, whereby the tissues are given opportunity to regain their normal resistance. If the tissues are incapable of return to normal while kept dry through use of powder, recurrence of discharge may be expected with discontinuance of treatment.

7. Specific treatment that produces for us the highest percentage of successful results consists in the continued use of autogenous vaccines and dry cleansing of the vagina, together with applications of powder. Local treatments with iodine or other drugs are possible sources of help.

In the future good may come through X-ray, radium, or specific drug therapy. There will doubtless always remain uncured a considerable percentage of cases in which systemic disturbances or local lack of resistance are so pronounced that no form of treatment can overcome the local infection and discharge.

Many thanks are due Dr. Thomas J. Watkins for material furnished and for constant and helpful interest shown throughout the course of this work.

INTESTINAL POLYPOSIS WITH REPORT OF CASE WITH THREE INTUSSUSCEPTIONS

By T. BRATRUD, B. A., M. D., Warren, Minnesota

IN presenting this article the writer desires to call attention to a class of tumors in the gastro-intestinal tract which manifest themselves in various ways and are interesting from several standpoints.

This class of tumors are of importance clinically for the relation they bear to (*a*) intussusception, and (*b*) secondary changes in the tumors with marked tendency to malignant degeneration. The scarcity of American literature in contrast to the volume of English and European publications would suggest that this condition is more common in European countries, and may throw some light on the etiology. There is no clear cut definition of the boundaries of so-called "intestinal polyposis" or "intestinal polyposa adenomatosa." Whether the numerous reported cases of single polypi showing hyperplasia of typical cells occurring in the gastro-intestinal tract belong to the symptom-complex of intestinal polyposis or not, the writer is not prepared to say. It strikes the writer that the term "gastro-intestinal polyposis" would define more correctly this condition in its various phases. Structurally, the growths in the numerous cases of so-called gastric polyposis are identical with those found in the intestine. Furthermore, several cases are reported under the head of intestinal polyposis where multiple polypi were found in the stomach, jejunum, and ileum, as in Petrow's (1) case.

Meulengracht (2) reports two cases of multiple polypi found in the stomach which he calls gastritis polyposa. These polyps differ in no way structurally from the tumors described by Verse (3) in his extensive monograph quoting 196 references. There seems to be some confusion in the definition of the word polyp. Wade (4) describes a case of intussusception of the stomach into the duodenum, due to gastric polyp, which on further description he defines as fibromyoma. Fenger (5) in his article on benign tumors of the ileum quotes a bibliography dealing largely with polyposis.

There is also a great deal of confusion regarding the dividing line between the term polyp and adenoma, so that Hauser (6) in describing this condition uses the term "polyposis intestinalis adenomatosa." Verse admits the difficulty or impossibility of drawing a sharp dividing line between the polyps and adenoma. Adami (7) speaks of polypoid tumors of the small intestine having the general structure of adenomata. Hertzler in his recent work on tumors speaks of the intestinal polypi as hyperplasia of the mucous membrane. Kaufmann (8), in discussing tumors of the intestine, speaks of the adenomata as polypoid and papillary, varying within wide limits in size and distributed along the whole gastro-intestinal tract. Murphy (9) reviews the article by Kassemeyer (10) who reports 224 cases of intussusception caused by tumors of which 116 were benign, and of the benign be found polyps and adenomata 73 times.

The important side of the question clinically in dealing with mechanical obstruction of the bowel due to a polyp or adenoma is how far we should go in determining the existence of more tumors that may cause subsequent obstruction. Watts (11) describes a case operated upon four different times for intussusception, the intussusception at each operation being caused by what Watts calls "polypoid adenomata." Hartmann (12) describes a case with symptoms of pyloric stenosis where a double intussusception was found in the small intestine with multiple tumors which he describes as adenomata. Karajan (13) reports a case of intussusception which had several attacks and at operation five incisions were made in the intestine to remove polypoid tumors which Stoerck describes as having all the elements of normal mucous membrane. There are numerous reported cases of intussusception due to single polyp or adenoma. It would be interesting to follow up a large number of such cases with reference to (*a*) subsequent intussusception and (*b*) malignant changes. I remember one day at an autopsy in a well-known laboratory where the pathologist was happy in having demonstrated a primary carcinoma of the liver and in the midst of his rejoicing a clinical assistant appeared and recognized the case as the same from which he had one year previously removed a rectal polyp.

The etiology of this condition is not clear. Some writers on the subject whose observations are confined to post-mortem work believe that some diffuse inflammatory condition is a factor. The observations of numerous others do not bear this out.

The symptoms of intestinal polyposis vary within wide limits. Rectal polypi often produce marked tenesmus and bleeding and are easily discovered. Multiple tumors higher up may cause cachexia due to ulceration and hæmorrhage and may be considered as a probability in obscure abdominal conditions. In some cases small polypi have sloughed and have been found in the stools. This fact is worthy of bearing in mind in cases with history of colics with obscure etiology. The history of repeated attacks of colic with symptoms pointing to obstruction, as illustrated by reported cases, should suggest polyposis in obscure cases. That intussusception caused by intestinal tumor may result in spontaneous healing is shown by Hatfield (14). Analysis of the reported cases suggests that there is a type of recurring intussusception which reduces spontaneously. Our case supports this view as the history of her previous and recurring attacks corresponds closely to the attack she had on admission to the hospital, when the left-sided tumor disappeared with temporary relief of symptoms. Kassemeyer's study shows that intussusception plays the principal part in the symptomatology.

The common type of polyp that we recognize clinically is found in the rectum. A large number of the rectal polypi show more or less inflammatory changes and not so much of the adenoma type. The greater part of the cases on record were not discovered until autopsy and it is probable that many cases present no symptoms until obstruction results or malignant and metastatic processes develop. The great tendency of rectal polypi to carcinomatous degeneration is shown by Rotter (15) who collected 50 cases of rectal polypi with carcinomatous degeneration in 31. How this ratio compares with other gastro-intestinal polyps, we can not state.

Regarding location, the ileocæcal region leads in frequency of attack.

Treatment. On account of the wide distribution along the gastro-intestinal tract and the great variation in number from one (if a single polyp can be classed with polyposis) to several hundreds, the treatment must necessarily vary with the individual case. The mortality is large in the operated cases, practically that of neglected cases of intussusception. Whether resection shall be made or the individual tumor groups ablated must be determined by the number and location of the tumors, as well as the condition of the patient. The futility of radical excision in rectal polyposis by some Kraske type of operation is shown by Brentano (16), as in adopting a similar procedure we are not assured of the absence of polypi higher up in the intestine. The tendency to malignant changes in the multiple polypi, especially of the rectum, is accepted. Tuttle (17) states that single polypi do not undergo malignant degeneration. Mayo (18) and others have reported cases of single polypi with malignant degeneration.

Case report. Minnie J., admitted to the Warren Hospital July 30, 1913, age 16. Family history negative. The fourth child in a large, healthy family. Had measles two years ago. Otherwise well until a year ago. Has never menstruated. One year ago had an attack of severe colicky pain in lower abdomen and over sacrum lasting about twenty-four hours. Vomited very profusely several times during this attack. Had four or five similar attacks at intervals of about a month and her symptoms were attributed to beginning menstruation. During the last six months, similar attacks have been increasing in frequency, severity and obstipation and last from two to four days. Has vomited constantly the last three days. Constipated for the past year.

Present condition: Fairly well developed young girl. Poorly nourished. Tongue heavily coated. Looks ill. Lungs and heart normal. Hæmoglobin 75 per cent. Urine contains pus-cells, no albumin or sugar. Pulse 90. Temperature 100°. Abdomen somewhat distended and a sausage-shaped swelling is felt above left Poupart's ligament. This swelling is quite freely movable. Rectal examination negative. Patient vomits frequently large amounts of greenish thick fluid. After enema, profuse foul-smelling bowel movement with a disappearance of tumor.

July 31st. Patient feeling better. Free from pain. No tumor felt. Has taken some liquid nourishment.

August 1st. During the night patient taken with severe pain and profuse vomiting. A hard mass can be felt above Poupart's ligament on the left side. Repeated enemata without effect. Pulse 110. Temperature 100°. Some form of intussusception being suspected, operation was advised and accepted.

Transverse incision. Some straw-colored fluid in abdominal cavity and a mass felt in lower abdomen which was easily delivered and found to consist of an invagination of the upper end of the sigmoid. This was easily reduced. After reducing, two masses were felt in the bowel in the location corresponding to the apex of the invagination. Attempting to milk these masses along produced an invagination of the bowel wall. The serosa was somewhat reddened and not infiltrated. Bowel incised opposite mesosigmoid and two grayish spongy tumors, globular in shape and about 4 cm. in diameter, were found which were attached to mucosa by two thick pedicles. The tumors were cut away and wound in mucosa sutured with catgut. Bowel closed with through-and-through sutures of catgut and linen suture of the serosa. Patient recovered nicely and was just to be discharged August 17th when she was again taken with vomiting and severe colicky pains and at this time a tumor was felt in right iliac fossa freely movable. An enema with free stools relieved the pain and vomiting and tumor disappeared. Was doing nicely until August 20th when symptoms returned and at this time enemata failed to relieve the condition. At this time the true condition present was suspected. Operation was advised and accepted.

By transverse incision just below umbilicus the following condition was found. An invagination of the ileum and caput coli into the ascending colon formed a tumor about nine inches long. This was reduced and a tumor-mass, similar to the one found at the former operation, about nine inches above the ileocæcal mass, was felt. This time a thorough examination of the entire gastro-intestinal tract was made. Beginning at the lower end of the sigmoid, the entire colon was examined with negative results. The site of the former incision into the sigmoid could not be located. About twelve inches above the tumor-mass in the lower end of the ileum another mass was felt. High up in the abdomen on the left side another hard mass was discovered which on delivery proved to be an invagination of the ileum into the ileum making a tumor about six inches long. An interesting phenomenon was noticed here. The invaginated portion was blanched and anæmic, apparently in a tetanic contraction and the invaginating end above the point where the free bowel entered the invagination would alternately relax and contract, becoming rigid and anæmic. This was also reduced without much difficulty and a mass was felt here at a point corresponding to the apex of the invagination. On examining the rest of the intestinal tract including the stomach, no more tumors could be palpated.

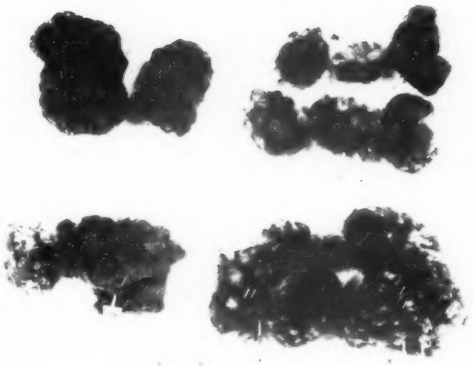


Fig. 1. The four groups of polypi removed from the following locations: Group 1, sigmoid; Group 2, 9″ above ileocæcal valve; Group 3, 12″ higher; Group 4, upper ileum.

Now the problem was, how to deal with these three groups of tumors felt in the lumen of the bowel at such distances apart that they could not be removed by one resection. On account of the patient's poor condition and the ease with which the tumors were removed during the first operation, we decided to remove the tumors by incision into the intestine and cutting them off from the mucous membrane as done in the first operation. This was accomplished with little or no difficulty except with the middle group where there were four small tumors with no pedicle and part of the entire thickness of the bowel wall had to be resected and closed, after the Maunsel method. Patient reacted nicely from the operation and was discharged from the hospital September 6th feeling well.

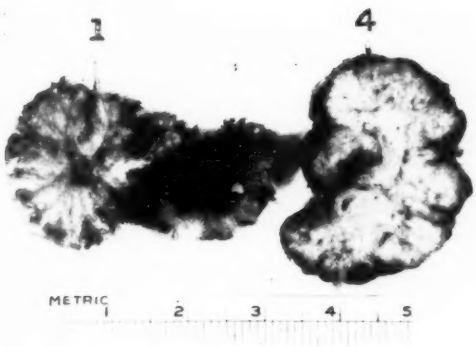


Fig. 2. Cut surface of polypi from Groups 1 and 4.

Word received later from patient states that she is in perfect health and has gained twenty pounds in weight.

Pathological report by Professor H. E. Robertson, University of Minnesota.

MULTIPLE INTESTINAL POLYPI

The specimens consist of four groups of polypoid tumor-masses. Group No. 1 was removed from mucous membrane of the sigmoid and is composed of two irregularly lobulated, roughly rounded polypoid masses, each measuring about 3 cm. in diameter. The surface of each is composed of several nodular lobes separated by deep clefts, which in turn are made up of tiny lobules averaging about 1 mm. across and producing a slight bossed or hobnail appearance. Slimy mucoid-like substance bathes the surface, which is dotted by grayish-white opaque spots on the semitranslucent, colloid-appearing ground substance. On section the lobes

Fig. 3. Microphotograph showing section of folded type of polyp growth. Note resemblance to normal mucous membrane. Magn. 6 X.

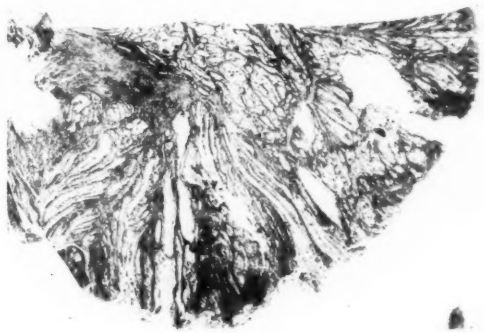


Fig. 4. Microphotograph. Section of papillary type of polyp. The irregular branching character of the trabeculæ is characteristic of the larger number of the polypi found in this case. Magn. 6 X.

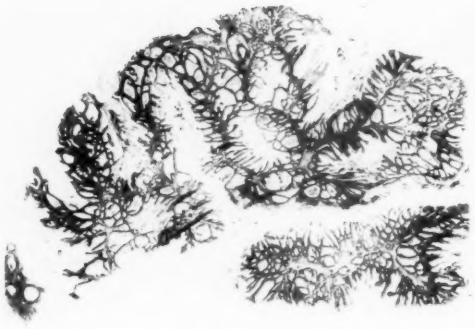


Fig. 5. Microphotograph. Section of branching or arborescent polyp. The connective-tissue framework is more delicate than in Fig. 4. Magn. 6 X.

Figs. 6, 7, 8, 9. Microphotographs showing appearances of epithelium and stroma in various portions of the polypi. Much of the stroma shows inflammatory infiltration of cells. The tall mucous cell predominates in all the sections. Magn. 180 X to 300 X.

have a radial arrangement of substance with large central blood-vessels and a fairly soft pulp of a semitranslucent, grayish-white color, with intervening bands of moderately dense connective tissue. The cut surface of the sessile attachment or pedicle of each polyp does not measure over 1 cm. in diameter.

Group No. 2, removed from the mucous membrane of the ileum at a point about 30 cm. above the ileocæcal valve, consists of two masses, the larger measuring about 3 cm. in diameter and having a surface which is thrown into irregular folds rather than lobes and a pedicle measuring 1.5 cm. in thickness and 1 cm. in length. Otherwise, it resembles those of Group No. 1. The second mass measures 2 cm. in diameter and represents a single lobe or nodule similar to those described in Group No. 1.

Group No. 3, removed from ileum at a point 46 cm. above valve, consists of about six masses, five resembling in size and shape and appearance the smaller one of Group No. 2, and one composed of a folded mass resembling compact thickened mucosa and measuring 1.5 cm. in length and 1 cm. in height and 1 cm. in breadth.

Group No. 4 was removed from ileum at a point about 194 cm. above valve and is made up of two masses, one measuring 3x2x2 cm. and having two lobes, the other a single lobe 2 cm. in diameter. Except for having a slightly denser consistence, these resemble the tumors of Group No. 1.

Microscopic examination. The lobulated masses consist of arborescent networks of connective tissue lined on both sides with a continuous single layer of tall epithelium, resembling goblet-cells in every respect. Cross section of this epithelial lined network gives the appearance of numerous irregularly

Fig. 7.

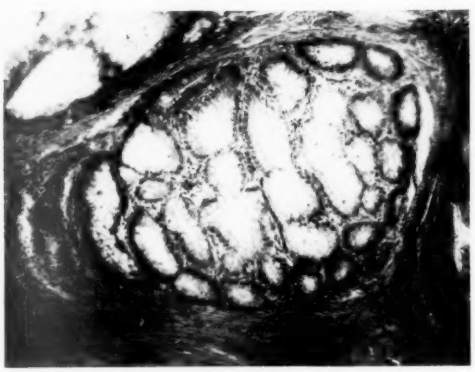


Fig. 8.

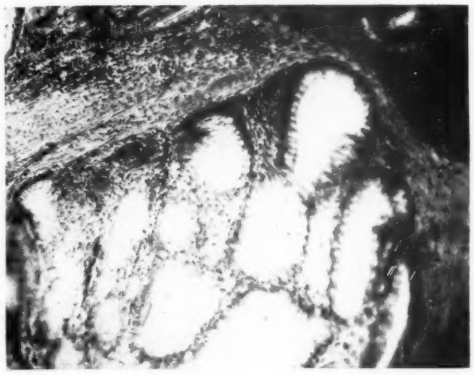


Fig. 9.

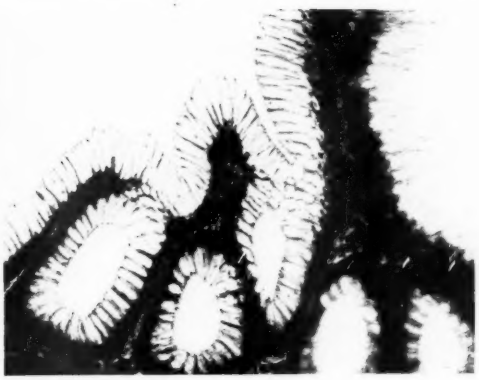


Fig. 10. Microphotograph. High power view of characteristic goblet-cells simulating gland ducts in their arrangement. Magn. 350 X.

rounded acini of various sizes. Near the outer surface areas of hæmorrhage are common while a thick mucoid exudate is everywhere abundant. Foci of lymphoid cells are common in the connective tissue and occasional areas show infiltration of polymorphonuclear leucocytes. The folded portions show a mass of tall, irregularly dilated and branching tortuous gland ducts somewhat resembling those found in the mucosa of the ileum. Goblet-cells still predominate but the ducts are more compactly arranged and the individual cells are not so large. On the outer surface is acute inflammatory exudate and necrosis. The deeper layer of connective tissue resembles submucosa, containing large blood-vessels and showing many foci of lymphocytes. No smooth muscle is visible in any of the specimens.

BIBLIOGRAPHY

1. PETROW. Zentralbl. f. Chir., 1896, p. 542.
2. MEULENGRACHT. Hosp. Tid., 1913, No. 43, 1261.
3. VERSE. Über die Entstehung, den Bau und dae Wachsthum der Polypen Adenome und Karzinoms des Magen Darmkanals. Leipzig, 1908.
4. WADE. Surg., Gynec. & Obst., xvii, 184.
5. FENGER. Collected Works, ii, 705. Benignant tumors of the ileum.
6. HAUSER. Deutsches Arch. f. klin. Med., lv, 1895.
7. ADAMI. Vol. 2, 452.
8. KAUFMANN. Spec. Path. Anat., p. 430.
9. MURPHY. Gen. Surg., 1913, p. 461. Practical Medicine series.
10. KASSEMEYER. Ztschr. f. Chir., 1912, August.
11. WATTS, S. H. Ann. Surg., Phila., liii, 408.
12. HARTMANN. Internat. Obst. Surg., 1913, xvii, 153.
13. KARAJAN. Wien. klin. Wchnschr., 1899.
14. HATFIELD, M. P. Int. Clin., 1897, sec. 6, iv, 248.
15. ROTTER. Arch. f. Klin. Chir., lxxxiii, 310.
16. BRENTANO. Zentralbl. f. Chir., 1909, No. 15, 530.
17. TUTTLE. Diseases of the rectum and pelvic colon.
18. MAYO. Ann. Surg., Phila., 1896.

PYONEPHROSIS

By CHARLES H. CHETWOOD, M. D., New York City
Professor Genito-Urinary Surgery, New York Polyclinic; Visiting Surgeon, Bellevue Hospital

MY reason for selecting that condition known as *pyonephrosis* as the subject of this communication is not only because of its importance as a lesion by itself, which is a terminal one, but on account of the varied causative conditions that lead up to that of pyonephrosis.

Bacterial inflammation of the kidney may begin in the pelvis or the medulla, and when suppurative nephritis terminates in diffuse destruction by the formation of multiple abscess foci (Figs. 1 and 2), which merge into one or more cavities, we then have one or the other type of pyonephrosis; or the condition may start as a hydronephrosis, and in consequence of a superadded infection, develop pyonephrosis, with marked dilatation and little normal kidney structure remaining (Fig. 3). On the other hand, when the process begins in the kidney substance, as in pyelonephritis, there is extensive destruction of the parenchyma, and only moderate dilatation of the pelvis (Figs. 4 and 5).

To recite the various methods of bacterial infection of the kidney is to mention the causative agencies of pyonephrosis. Thus, cases which occur primarily in the kidney, and which are lymphogenous or hæmatogenous in derivation, are usually descending in type, such as infected hydronephrosis, multiple septic infarction, and calculus or tubercular pyelonephritis (Figs. 6, 7 and 8); while those that are ascending in type are urogenous in derivation, sometimes acute, but usually chronic suppurative pyelonephritis or surgical kidney (Figs. 15 and 16).

The predisposing factors, therefore, in pyonephrosis, are:

1. Hydronephrosis (example Fig. 3).

2. Previous morbid lesions of the pelvis: pyelitis; pelvic stone (example, Figs. 6, 9 and 10).

3. Previous morbid lesions of the kidney: single or multiple focal abscesses; tuberculosis (examples, Figs. 1, 2, 4, 5, 6 and 7).

The ordinary pyogenic organisms are the invading agents in pyonephrosis, principally the bacillus coli, sometimes streptococci and staphylococci, when suspicion is directed toward a hæmatogenous infection. Gonococcic infection is infrequently the cause, although authentic cases tend to show a somewhat greater number of such than was formerly suspected.

Lenhartz, in a study of sixty cases, found the bacillus coli in fifty of them. The encapsulated pus in pyonephrosis, as illustrated in the accompanying pictures, is contained in several cavities (Fig. 1), which may or may not communicate, or in one enormous sac (Fig. 3). The former occurs when the suppuration begins in the kidney substance, the exterior presenting a lobulated appearance (Fig. 2); and the latter is an outcome of hydronephrosis, when on section the organ will completely collapse, showing a large, thin-walled cavity. The pus is usually thick, creamy, and foul of odor, when due to infection by the bacillus proteus and certain strains of the bacillus coli. The association of renal calculus is very common, as shown in some of the illustrated cases (Figs. 1 and 6).

Pelvic stones are likely to be primary, and one of the causative factors of the condition (Fig. 6). Secondary stones are deposited at the site of abscesses of the malphigian pyramids. The superadded condition of tuberculosis may present the same appearance as without such coexistence (Figs. 4 and 7), the walls of the abscess being lined with tubercles. In pyonephrosis, the ureter may be normal, or may undergo an enormous dilatation, and in the so-called ascending types, in which there is a double urogenous infection, dilatation of the ureter may be double, and the picture that of general vesico-ureterorenal distention.

In some cases, the *clinical history* is that of the preëxistent condition; namely, prolonged cystitis and pyelitis, or sudden or progressive infection of the kidney, or tuberculous or pyogenic infarction. In other cases, the first

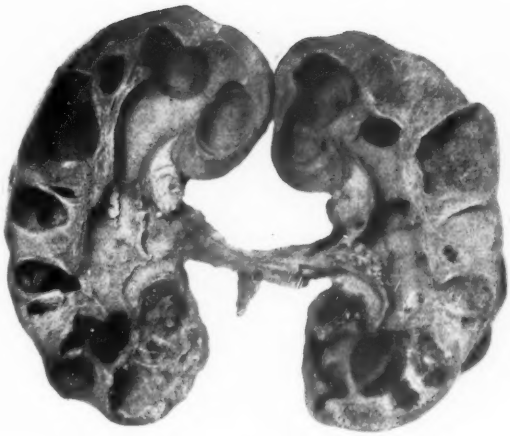


Fig. 1. Pyonephrosis — multiple cavities.

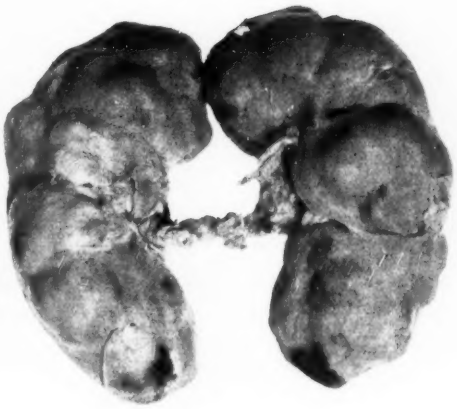


Fig. 2. Same case as Fig. 1 — exterior view (lobulated appearance).

symptom may be that which brings to light the pyonephrosis.

Pain is generally dull in character and located in one or the other hypochondrium or loin. There may be only a trace of tenderness and pain on deep pressure in the loin, in the lumbar region, or at the costovertebral angle. A rounded or irregular mass may be felt by bilateral pressure, and the condition may exist without a palpable kidney.

The urine, on gross examination, shows nothing more than is found in cystitis: a general turbidity, due to the presence of pus and bacteria; but as a clinical observation, it is well to bear in mind that profuse pyuria, with pus equally distributed in two or three flows, without the evidence of marked vesical irritability, is suspicious of pyonephrosis. The constitutional symptoms may be slight. Such is a general outline of the salient features in an open or draining pyonephrosis.

In so-called closed pyonephrosis, when the ureteropelvic outlet is occluded, the urinary symptoms are lacking, but in this case the constitutional symptoms are in proportion to the acuteness of the inflammatory process.

A veritable connective-tissue sac, containing little kidney substance and nothing more than an accumulation of pus (Fig. 3), may afford neither urinary evidence or constitutional symptoms of importance, and the bladder urine will represent only that which is derived from the uninfected kidney. A sudden closure of an open pyonephrosis is apt to be signalized by the occurrence of sharp constitutional symptoms.

From the foregoing facts, it is appreciated that the *diagnosis* cannot be made from the clinical picture or previous history, and this

Fig. 3. Pyonephrosis — single cavity (infected hydronephrosis).

Fig. 4. Tuberculous pyelonephritis — multiple cavities.

applies to pyonephrosis, as well as to the preëxisting condition, pyelitis.

In the Vienna General Hospital, before the present methods of diagnosis with cystoscopy, radiography, and pyelography were as frequently practiced, in more than two-thirds of 750 cases of pyelitis upon which autopsies were performed, a diagnosis had not been made. Whether or not there is a palpable tumor is not conclusive, on account of the possibility of other retroperitoneal growths, and the diagnosis must rest largely upon cystoscopy, ureteral catheterization and radiography.

Cystoscopy. In secondary or ascending cases, cystoscopy will reveal the presence of the primary lesion in the lower urinary tract.

Fig. 5. Pyelonephritis with destruction of kidney.

Fig. 6. Calculus pyonephrosis (stone in pelvis and parenchyma).

In primary renal infected cases, the bladder, even after a long-existing pyuria, may show little change.

The ureteral orifice of the affected side usually shows a gaping œdema, and a block of pus is not uncommonly found exuding its way out of the opening; while it is possible that the ureteroscopic picture may be far from abnormal, even in advanced cases. In a personal case in which both kidneys were involved, on the one side, on which the kidney was contracted to the size of a small oyster, the ureteral mouth was dilated, whereas in the opposite kidney, although there existed a huge pyonephrotic sac and a dilated ureter the size of the small intestine, the ureteral mouth on the bladder side was small and normal in appearance.

Catheterization of the ureter, as a rule, obtains on the infected side turbid, whey-like urine or pure pus, except in closed pyonephrosis, when no secretion whatever is obtained.

Renal radiography will reveal the presence of calculi (Figs. 11 and 12), and pyeloradiography the outlines of a rounded or lobulated tumor (Fig. 13), as shown in the cases.

Fig. 7. Tuberculous pyelonephritis.

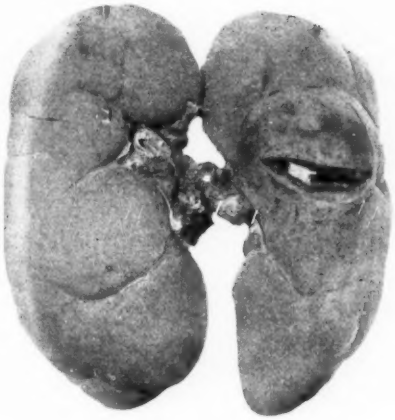


Fig. 8. Same case as Fig. 7 — exterior view (cortical abscess).

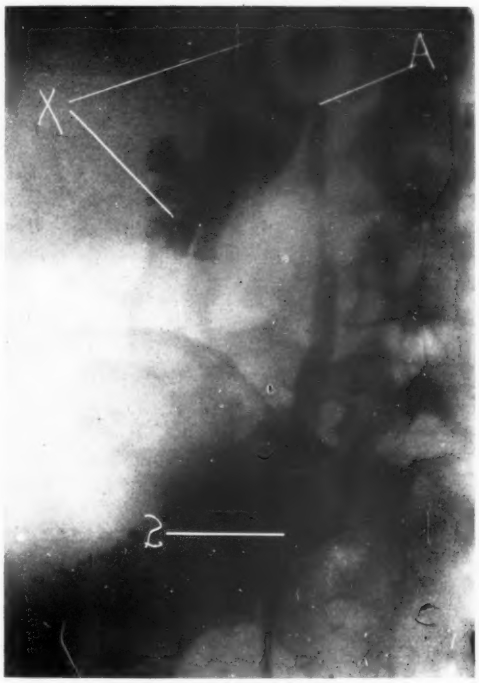


Fig. 9. Collargol radiograph showing prolapsed kidney and distended pelvis.

Fig. 10. Same case as Fig. 9 after operation.

Fig. 11. Radiograph of renal calculi (same case as Fig. 6, kidney removed).

Fig. 12. Renal calculi — little or no kidney impairment.

The measures of *treatment* to be adopted are palliative or radical: operative and cystoscopic.

By palliative measures are meant anything short of operative interference and exposure of the kidney. Such measures are not to be countenanced in the case of advanced kidney lesion, except where operation is rejected, or where the patient's condition does not warrant such a step. In such a case drainage of a

Fig. 13. Collargol radiograph showing lobulated appearance of pyonephrotic kidney.

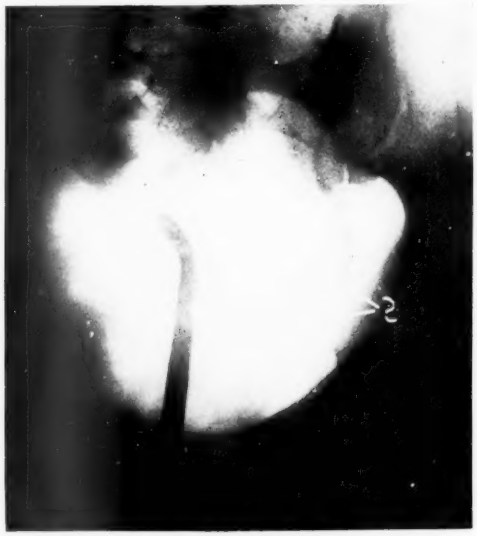


Fig. 14. Stricture of ureter and pyelonephritis (collargol picture).

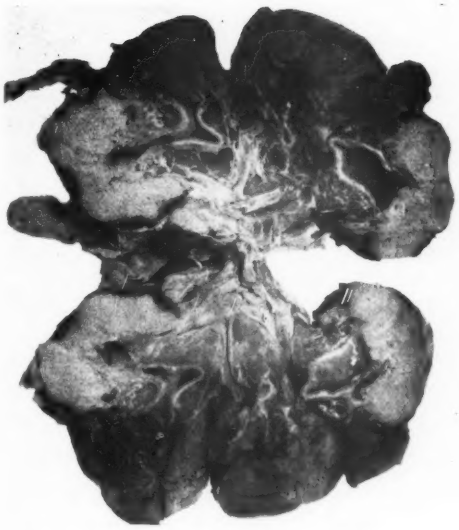


Fig. 15. Chronic pyelonephritis ascending (surgical kidney, right side).

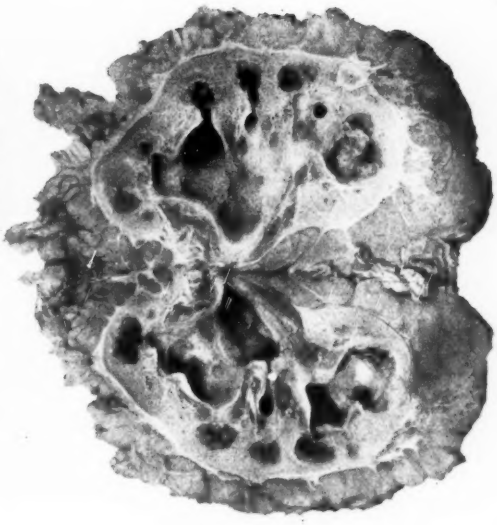


Fig. 16. Same case as Fig. 15 — opposite kidney.

suppurative kidney may be effectively accomplished by the introduction from below of a ureteral catheter, which is left *in situ*, with or without lavage of the purulent sac. Lilienthal has reported a successful series of cases of different types. One of the cases illustrated here is an example of this means of treatment (Fig. 14).

Otherwise, the measures of treatment are operative. The choice of operation lies between nephrectomy and nephrotomy — nephrotomy when there is doubt as to the functional value of the other kidney, and when there is great urgency on account of septic uræmic symptoms, which do not allow time for careful study of the case. This is illustrated in one of the cases of this series (Fig. 15), and although a fatal issue ensued, the condition of the opposite kidney after death justified the conservatism of this measure, as the remaining organ was useless (Fig. 16). If necessary, a secondary nephrectomy may be performed later, when the capacity of the other kidney has been established.

On the other hand, should the functional tests and laboratory examinations show the opposite kidney to be capable of performing the required work, primary nephrectomy is usually *the operation of choice*.

With the coexistence of tuberculous infection, and the integrity of the other kidney proven, nephrectomy is *the operation of necessity*.

HÆMORRHAGIC OSTEOMYELITIS[1]

By GEORGE BARRIE, M. D., New York City

With Observations on its Pathology

By O. S. HILLMAN, M. D., New York City

THE term hæmorrhagic osteomyelitis is meant to embrace a majority of those traumatic, localized, non-infective (so far as we know at present), non-suppurative, low-grade inflammatory lesions that have their onset in spongy bone.

The term is also used to express more exactly and correctly the lesions which at present are classified under a variety of names, more or less misleading, such as medullary giant-cell sarcoma, myelogenous giant-cell sarcoma, myeloma, medullary giant-cell tumor, benign bone cyst, osteitis fibrosa, traumatic solitary bone cyst, etc.

Under the single heading "hæmorrhagic osteomyelitis," and its subdivision into two forms, one is able to include the different phases the chronic lesion assumes, and thus avoid the mixed terminology at present in use.

What may be called the systemic bone lesions, such as syphilis, tuberculosis, rickets and metaplastic osteomalacia, are excluded. (The latter term was originated by von Recklinghausen in 1910 to include his previously described disease, osteitis fibrosa, and also the non-cystic form, osteitis deformans of Paget). Also are excluded the lesions due to the acute infections or parasites.

The following simple classification is suggested for consideration:

HÆMORRHAGIC OSTEOMYELITIS

Traumatic. Localized. Non-infective (?). Non-suppurative.

Acute. Never observed.

Chronic —

Type A, hæmorrhagic (shows little or no metaplastic change).

Type B, fibrocystic (due to later metaplasia).

A. Chronic hæmorrhagic osteomyelitis —

Synonyms:

1. Medullary giant-cell sarcoma.
2. Myelogenous giant-cell sarcoma.
3. Myeloma.
4. Medullary giant-cell tumor (Bloodgood).

B. Chronic fibrocystic osteomyelitis —

Synonyms:

1. Benign bone cyst.
2. Osteitis fibrosa.
3. Chronic osteomyelitis fibrosa — cystic or solid (Bloodgood).
4. Traumatic solitary bone cysts (Felten and Stolzenberg).

The experiments and researches of Ullman, Warren, Felten and Stolzenberg, and others have clearly demonstrated that a slight trauma is sufficient to cause factures of the delicate normal bone trabeculæ of the long bones, producing effusion, hæmorrhage, and interference with nutrition, thereby setting up a localized osteomyelitis. Trauma seems to be the starting point in the production of these solitary, non-infective, non-suppurative, low-grade, inflammatory lesions. It is quite easy to understand that destruction of the trabeculæ will have a pathologic effect on the venous sinuses that are supported by it, causing thinning of the vessel walls, which possess no muscular fibers, and their dilatation and varicosity, transudation, and possible rupture. The varicosed and dilated vessels are also a constantly active factor, with the aid of the forming granulation tissue in which they are enmeshed, in the further rarefication and progressive destruction of the bone from pressure necrosis.

This constitutes a localized low-grade osteomyelitis. Immediate effort at repair begins with the formation of primitive hæmorrhagic granulation tissue, with metaplasia, resorption, regeneration, and restoration of architectural arrangement of structures and function, and the lesion is cured; or rarely becomes chronic.

[1] Read before the Surgical Section, New York Academy of Medicine, March 6, 1914.

The writer[1] described in detail the etiology, symptomatology, gross pathologic picture, and histopathology the chronic lesion presents.

The chronic lesion may remain hæmorrhagic in form (type A), or later assume fibrocystic changes (type B). Just what chemotactic properties of the blood permit one lesion to go on to fibrous metaplasia and allow the other

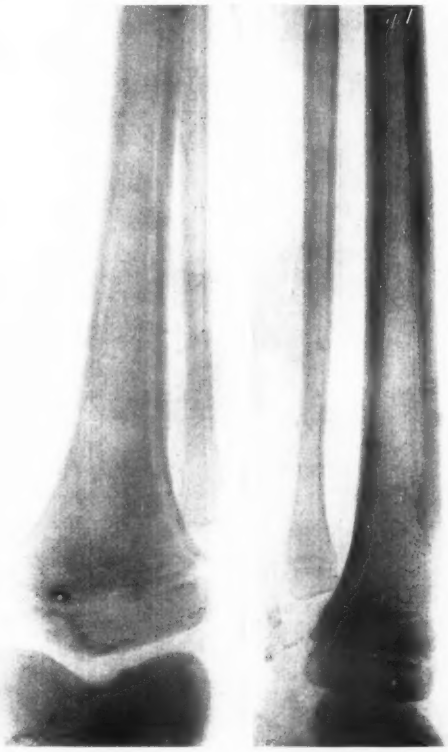


Fig. 1. Case No. 1. X-ray showing lesion in lower end of tibia.

to retain its primitive hæmorrhagic form must be a subject of further study.

Type A — Chronic hæmorrhagic osteomyelitis. This is a low-grade inflammatory process, showing progressive proliferation of highly hæmorrhagic granulation tissue, of tumor-like formation. Preceding and going hand in hand with proliferation, there is steady

[1] Ann. Surg., Phila., 1913. Feb.

Fig. 2. Case No. 2. X-rays showing normal bones on left and lesion in acromial end of ulna on right.

and constant destruction of bone trabeculæ from pressure necrosis, and nutritional inhibition.

Throughout the life of the lesion the granulation tissue as a rule shows no metaplastic change, but retains its general primitive hæmorrhagic type. Occasionally fibrous patches are seen in the granular mass, and quite frequently hyaline thrombi.

The appearance of the gross lesion in the fresh is unlike any of the known neoplastic growths, which is one of the writer's reasons for attacking the title of medullary giant-cell sarcoma which it has heretofore quite generally borne.

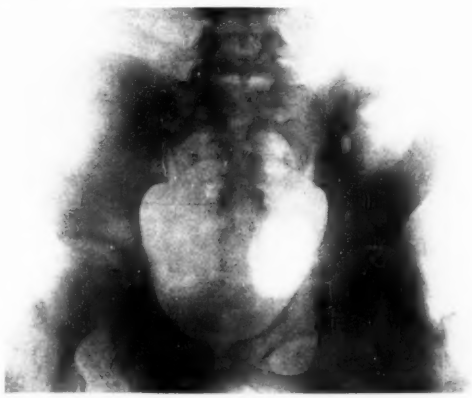
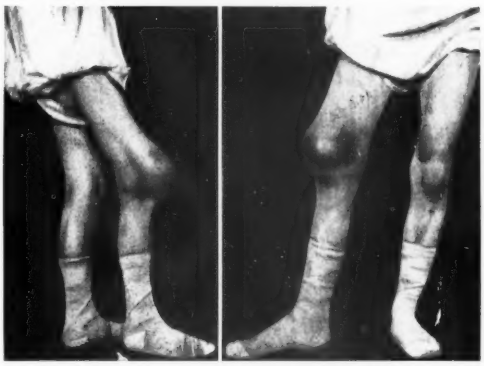


Fig. 3. Case No. 3. X-ray showing lesion in ilium external to right sacro-iliac joint.

Fig. 4. Case No. 4. X-rays showing normal bones on left and lesion in lower end of radius on right.

Fig. 5. Case No. 5. X-rays showing normal bones on left and small early lesion in upper end of right fibula.

Fig. 6. Case No. 6. X-rays showing advanced circumscribed lesion in upper end of fibula.



Figs. 7 and 8. Case No. 7. Photograph of patient before operation showing swelling at lower end of right thigh.

It has the typical look of hæmorrhagic, primitive, granulation tissue, red in color, somewhat friable and feels like jelly, is smooth and glistening, oozes and has the consistency of autopsied fresh brain tissue. As early as 1848, Stanley in his treatise on diseases of the

Fig. 9. Case No. 7. X-ray two months after injury and four years before operation. Early lesion in lower end of femur.

Fig. 10. Case No. 7. X-ray (lateral view) showing lesion more advanced. Erosion of anterior surface of femur.

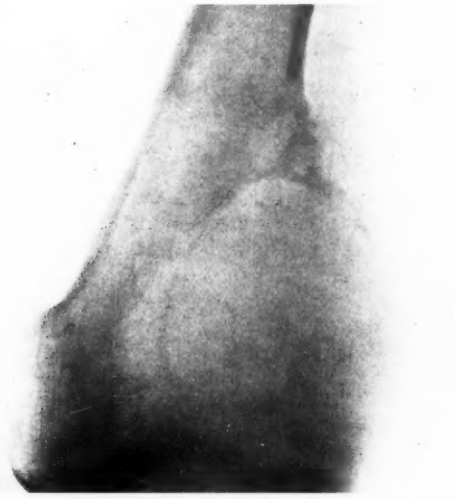


Fig. 11. Case No. 7. X-ray (anteroposterior view) showing lesion protruding externally through erosion in the bone.

Fig. 12. Case No. 7. Photograph of hardened gross specimen obtained by amputation, showing position of lesion. Erosion of lower end of femur (right) over anterior and external aspects.

Fig. 13. Case No. 7. Specimen split open showing contour and extent of lesion, erosion of posterior surface of femur, with projection of mass into popliteal space. Shell of internal condyle with mass in contact. Split head of tibia seen below.

bones fairly well described the lesion in the fresh as having the appearance of splenic pulp.

One of the purposes of this paper is to suggest the term "chronic fibrocystic osteomyelitis" for those solitary intra-osseous lesions in bone that begin as a localized, hæmorrhagic, probably non-infective traumatic process, but later take on metaplastic changes, fibrocystic in character. The term "fibrocystic osteomyelitis" defines more clearly and exactly the nature of the existing condition that the later stages of the lesions present, than those now in use, such as benign bone cyst, osteitis fibrosa, traumatic solitary bone cyst, etc.

Type B — Chronic fibrocystic osteomyelitis. This is a secondary stage of the hæmorrhagic type due to metaplasia, the granulation tissue being converted into replacement or proliferative fibrous structure. The more active the metaplastic reaction, the greater the tissue retraction and likelihood of cyst formation. It is the writer's observation that cystic areas are always present in the so-called solid lesion.

It is also an observation that the nearer the lesion is to the end of the long bone, the greater the probability of its retaining the hæmorrhagic granulation tissue type, metaplasia infrequently resulting. The blood supply in the ends of the long bones is much greater than in the shaft. Just what connection this may have as a factor is to be determined. On the other hand, metaplasia is more frequent with lesions some distance from the end of the bone.

It has been the contention of the writer for a long time that the lesion generally described as medullary giant-cell sarcoma, myelogenous giant-cell sarcoma, myeloma, and medullary giant-cell tumor, occurring in the ends of the long bones is wrongly classified, and the terms used are misnomers.

The lesion is not a sarcoma, neoplasm, or

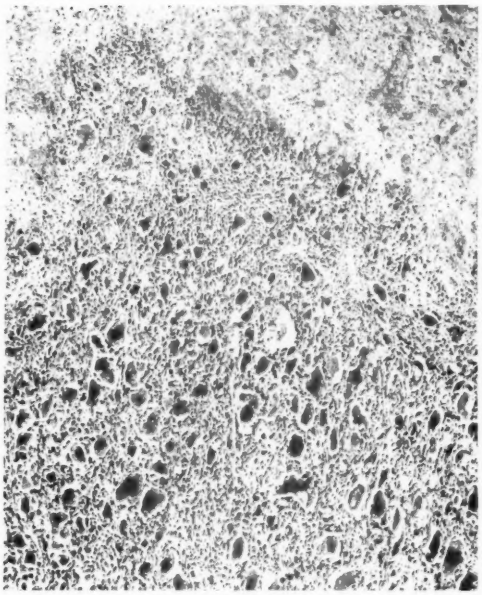


Fig. 14. Case No. 7. Photomicrograph of section from main mass showing numerous multinucleated giant-cells embedded in vascular granulation tissue. Area of necrosis at one end with leucocytic infiltration along boundary zone. X 80.

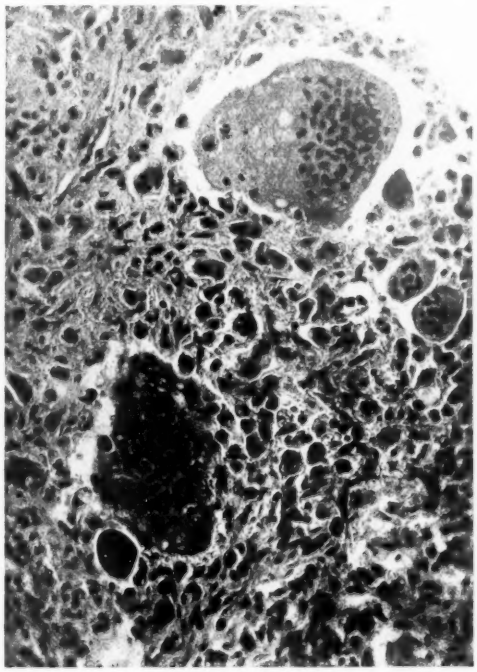


Fig. 15. Case No. 7. High power photomicrograph of section from main mass showing two large giant-cells with vacuolated and reticulated cytoplasm. A few smaller multinucleated cells are seen. Note polymorphous character of cells in stroma.

autonomous growth, but is in reality a low-grade inflammatory process, localized and due probably to trauma.

Those opposed to the view that the lesion is inflammatory assert the following points:

1. There is tumor formation.
2. There is steady increase in size of the lesion.
3. The microscopic picture of giant-cell riot and invasion is conclusive.

It is the dissection of such a picture that furnishes another reason for this paper.

1. *Regarding tumor formation.* Primitive granulation tissue will form tumor-like masses in any part of the body in which it is permitted to proliferate as such.

2. *Regarding steady increase in size.* According to Adami, "the striking feature of an inflammation caused by a gentle irritant is proliferation." Going hand in hand with destruction of the trabeculæ from disturbance of nutrition, and pressure necrosis due to effusion and dilated and varicosed blood-vessels, are seen constant efforts at repair by replacement granulation tissue.

3. *Regarding giant-cell invasion.* This has heretofore been the sheet anchor upon which the diagnosis of giant-cell sarcoma has been based: the histologic picture showing a field of giant-cell riot without architectural uniformity or arrangement.

It should be borne in mind that these cells are neither tissue builders nor tumor-forming cells. Their function is that of scavengers. Their presence is an evidence of, and is due to, a low-grade inflammatory non-suppurative process. They are rarely seen in acute inflammation, but are frequently observed in numerous mild chronic inflammatory conditions. These giant-cells are apparently formed by the fusion of many phagocytic endothelial cells, brought together as a result of the stimulus offered by disintegrating bone structure.

Fig. 16. Case No. 7. Photomicrograph of section from eroded internal condyle showing character of the soft tissue in proximity to the bone, infiltration of medullary fat with lymphocytes, proliferation of fibroblasts, congestion of blood-vessels, and a few giant-cells. X 80.

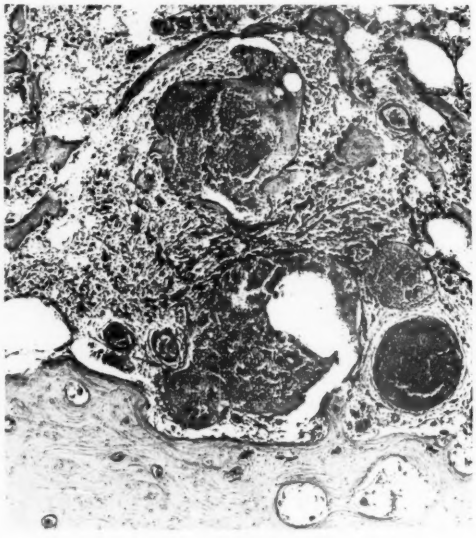


Fig. 17. Case No. 7. Photomicrograph of section from shaft of femur near area of contact with mass, showing dilatation and engorgement of blood-vessels, small hæmorrhages into perivascular tissue, disintegration and erosion of bone trabeculæ. X 80.

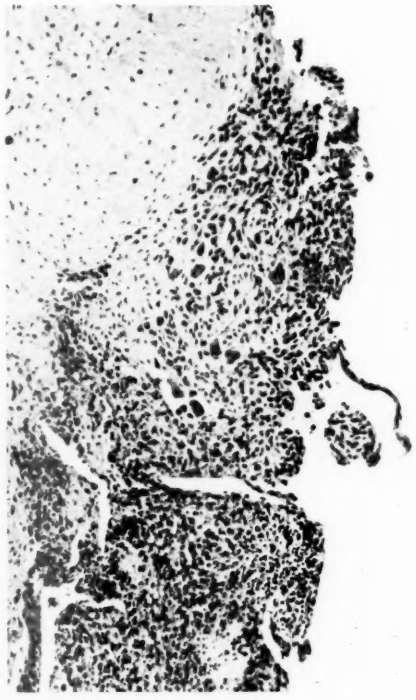


Fig. 18. Case No. 7. Photomicrogaph of section from periphery of lesion adherent to synovial membrane of knee-joint. Note fibrosis of membrane and a few giant-cells in vascular granulation tissue.

In other words, they are foreign body giant-cells that take up or dispose of the detritus and débris due to previous tissue destruction.

The term giant-cell growth, as applied, is therefore a misnomer. The lesion is a hæmorrhagic granulation tissue over-growth, due to an inflammatory process.

Dr. Bloodgood in his review in "Progressive Medicine" for December, 1913, states in part as follows:

"The term medullary giant-cell tumor expresses the exact finding, and it would be a mistake and misleading to drop the now well established terminology, giant-cell, for these lesions."

In the same review in discussing Case 2 of Mathews of New York, who uses the British term "myeloma," he states: "It is a typical giant-cell tumor," and, further on, remarks as

follows: "If we leave out the predominant cell, the giant-cell, we have a tissue resembling vascular granulation tissue."

It seems to the writer that the presence of granulation tissue in a lesion is the best evidence one can obtain of inflammation. As the giant-cells are simply phagocytes and add to the evidence of a present low-grade inflammatory process, the term giant-cell tumor does not seem to express the exact findings the lesion presents.

The term "tumor" as now applied always suggests a neoplastic autonomous growth.

Much more misleading, however, is the title "sarcoma." As these lesions are not malignant, the term is a misnomer.

Regarding an already well-established terminology—that is, "giant-cell"—it seems rather pertinent to recall that the term "rheumatism" was long an established one for the arthritides, which we now recognize as being inexact and incorrect. Scrofula until recent years was an established term for glandular tuberculosis, and there are many other long established names that have fallen by the wayside.

The writer suggests that the term "hæmorrhagic osteomyelitis" conveys more exactly the nature of the existing conditions these various localized traumatic lesions present, and at once places them in their proper classification with the inflammations.

From the foregoing considerations the writer desires to emphasize the following:

1. The so-called medullary giant-cell sarcoma of bone is in fact a localized regenerative inflammatory lesion, without evidence of malignancy.

2. Owing to the anatomical arrangement and structures involved, slight initial trauma is ample to account for the pathologic phenomena and progressive bone destruction that occurs, regardless of any infective process.

3. The giant-cells found in these lesions are neither tumor-cells nor tissue builders. They act in the capacity of scavengers.

4. A more simple terminology and classification is needed. The terms at present in use are numerous, confusing, and misleading.

The following cases are presented as being typical of the lesion under consideration:

CASE 1. W. W., male, white, age eleven years. Injury to leg and sprain of ankle two years ago. No trouble observed until one year ago. Since then has noticed that whenever he got tired the leg pained him.

Examination. Boy well nourished and healthy looking. Tender spot on anterior border of lower third of left tibia. Deep pressure causes pain. X-ray (Fig. 1) shows an area size of a marble apparently cystic in character; no other lesion. Wassermann negative.

Operation. Bone chiseled down to involved area, and hæmorrhagic granular tissue removed; no sign of fibrous structure or lining membrane; inner bony wall smooth.

Microscopic examination. Loose œdematous and moderately vascular granulation tissue. A few well-defined multinucleated giant-cells of the foreign body type are seen scattered throughout the tissue. No histologic evidence of malignancy.

Diagnosis. Hæmorrhagic osteomyelitis.

CASE 2. Pauline D. W., female, age six years.[1]

Later report. Returned for treatment, February, 1913. Wassermann negative. Von Pirquet negative.

Operation. Removal of cystic fibrous structure (no fluid) and lining membrane from bone cavity in acromial end of right ulna the size of a cherry.

Microscopic examination. Inflammatory fibrous tissue.

Diagnosis. Chronic fibrocystic osteomyelitis.

CASE 3. Harry F. K., male, white, age 14 years. Injury above right buttock, one year ago. Pain and tenderness since, treated at three hospitals for hysteria.

Examination. Localized tenderness and pain on deep pressure over right ilium near sacro-iliac joint. X-ray (Fig. 3) shows focus size of a five-cent piece, just external to right sacro-iliac joint. Wassermann negative.

Operation. Saucer-shaped fibrous tissue focus removed containing multiple, worm-eaten looking spots (cysts).

Microscopic examination. Inflammatory fibrous tissue.

Diagnosis. Chronic fibrocystic osteomyelitis.

CASE 4. J. N., male, white, age seventeen years. In May, 1913, was struck on the right wrist with a baseball, some pain following injury.

For last six months more or less pain in wrist, which stops for two or three days, and then returns. Several attacks of severe pain during past month. X-ray (Fig. 4) taken one week ago. Clinical and X-ray pictures negative as to tuberculosis or syphilis.

Clinical and X-ray diagnosis. Chronic hæmorrhagic osteomyelitis. Operation refused.

CASE 5. Max S., male, white, age sixteen years. For past four months feeling of discomfort in upper third of right leg. Tenderness over head of fibula; deep pressure causes pain. No history of injury. X-ray (Fig. 5) shows a focus size of a large coffee bean. Clinical and X-ray picture negative for

[1] The clinical history and X-ray pictures of this case were reported in Ann. Surg., Phila., 1913, February, 254.

tuberculosis. Wassermann negative. (This is the only case of the series in which a history of trauma has not been elicited. It is also the earliest case observed.) Operation refused.

Clinical and X-ray diagnosis. Chronic hæmorrhagic osteomyelitis.

CASE 6. M. B., female, white, age twenty-three years. Injury ten years ago. Never has suffered from pain. Tenderness on deep pressure. Leg uniformly enlarged in its upper third. Thinks leg has slowly increased in size. Causes no discomfort. X-ray (Fig. 6) shows circumscribed lesion and the deep shadows show hæmorrhagic structure. Wassermann negative.

Clinical and X-ray diagnosis. Chronic hæmorrhagic osteomyelitis.

CASE 7. H. S., male, white, age sixty-three years. Apparent age, seventy-three years. Foreign born, married, four children. Four years ago injured right knee; immediate pain and swelling. In bed two weeks; aspiration and removal of a tablespoonful of tarry fluid. Two months following injury X-ray (Fig. 9) was taken. Three months after onset of injury resumed occupation as packer and shipper of china. Remained well until two years ago when he fell a distance of twelve feet from the top of a lumber pile, injuring same knee. Has limped ever since. December 24, 1912, he slipped on the ice and struck right knee; laid up two weeks. In February, 1913, he was compelled to give up work on account of disability and pain standing or walking. March, 1913, began daily bakings of knee for one-hour periods; continued for five weeks without result. May, 1913, knee aspirated, small amount of clear blood removed. From this time motion in joint absent. Patient referred to me August, 1913, for treatment for chronic synovitis.

Examination. Lower third of right thigh and knee-joint enlarged (Figs. 7 and 8). Circumference right knee, 17 inches; right thigh (middle), 16½ inches; left knee, 13½ inches; left thigh (middle), 15 inches.

Veins dilated over affected area. Slight redness and heat. Is wearing a long brace and using a cane. Has no Romberg. Pupils normal. Patellar reflexes sluggish. General arteriosclerotic changes evident. Wassermann negative.

Clinical diagnosis. Hæmorrhagic osteomyelitis with possible malignant degenerative change.

X-ray diagnosis. Central sarcoma. (Figs. 10–11.)

Operative diagnosis. Hæmorrhagic osteomyelitis.

Operation. October, 1913. Vertical incision six inches long, anterior aspect, lower third right thigh. Lesion encountered immediately upon cutting through the œdematous soft parts. The anterior bony wall the size of a goose egg destroyed. The mass was very hæmorrhagic, reddish in color, quite friable, but firm in consistency and with the glistening appearance these lesions usually give; its surface was smooth, and even with, but not bulging through, the bone opening, probably due to the fact that previous to operation a tourniquet had been applied.

Owing to the patient's enfeebled condition and the evident poor vitality of the œdematous soft parts surrounding the lesion, I decided to perform amputation of the thigh in its upper third.

In a younger, robust individual, the more prolonged operation of resection, and transplantation, with obliteration of the knee-joint (under a similar pathological condition), would be indicated.

OBSERVATIONS ON THE PATHOLOGY OF HÆMORRHAGIC OSTEOMYELITIS

BY O. S. HILLMAN, M. D.

Gross pathologic examination. The lesion is located in the lower extremity of the femur, for the most part in the condyles, and presents to view through a jagged oval-shaped opening, 9.5 x 7 cm., in the anterior surface of the bone (Fig. 12). The appearance of the lesion in the fresh state is quite striking and has been noted above in connection with the operative findings of the case. Resemblance to vascular granulation tissue in lesions of this type is a feature that has been commented on by several observers. The amount of newly formed tissue is abundant, enough to nearly fill a half-pint jar was readily dislodged from around the edges of the opening in the bone and also from the presenting surface of the lesion. The mass of tissue remaining in the expanded end of the femur is roughly the size and shape of a clenched fist. After thorough preliminary hardening of the specimen, it was sawed open lengthwise and the full extent of the lesion exposed (Fig. 13). It measures 11 cm. in length and 6.5 cm. in the greatest anteroposterior diameter. Its boundaries are, on the whole, well defined. There is, however, no enveloping connective capsule. Below, it is limited by the gouged-out internal condyle, articular cartilages, and thickened synovial membrane. At no point has the mass broken through these structures into the knee-joint. Above, the line of demarcation from the medulla is plainly visible. As may be seen from Fig. 13, the lesion has eroded the external aspect of the lower end of the femur to a greater extent than it has on the inside, where there still remains a rough shell of bone representing what is left of the internal condyle. Externally, the lesion is limited by the com-

pressed tendons, muscles, and overlying soft tissues. The peripheral portion of the mass in contact with the eroded internal condyle, and with the shaft above, exhibits a discrete yellowish granular layer which, to the feel, suggests disintegrating bone. The hollowed-out condyle is hæmorrhagic in appearance, irregularly roughened, and from its cavity there may be scraped, here and there, softened osseous tissue. On sawing through the entire thickness of the condyle, the cut surface is seen to present a similarly softened and congested appearance. Posteriorly, the femur is destroyed over a distance approximating 5 cm.; through this aperture the mass has made its way into the popliteal space, where it shows a smooth posterior contour in apposition to the fatty tissue. The sectioned surface of the hardened lesion presents a variegated appearance; a large portion of it is dark red to reddish black in color, evidently due to altered blood. Elsewhere it is gray to a faint yellow. Occasionally small softened areas are seen; the mass crumbles readily on handling. No evidence of bone structure can be detected in the mass other than that noted on its peripheral erosive surface. Detached fragments of tissue removed from the face of the lesion and hardened in preserving fluids have a peculiar shaggy, worm-eaten appearance.

Microscopic examination. Blocks of tissue for microscopic study were taken from different portions of the main mass to show its variable histologic structure; from the eroded bone at several points in contact with the lesion; also from the synovial membrane and soft tissues below and external to the lesion.

The reddish black areas consist of hæmorrhagic extravasations from thin-walled, engorged blood-vessels together with dilated vascular spaces. There is also a good deal of fibrin in these areas. The lighter colored portions are made up essentially of young fibroblastic tissue, the most striking feature of which is the large number of well-defined multinucleated giant-cells (Fig. 14), varying in size from small cells with two or three nuclei to large structures containing as many as 100, or even more, nuclei. The nuclei show mainly a central, or unipolar, grouping, and, in the larger cells, are surrounded by an abundance of deeply staining cytoplasm, which is finely reticulated, granular, or vacuolated. The vacuoles are prominent (Figs. 14 and 15); many exceed the diameter of erythrocytes, while others are very small. Frozen sections stained with Scharlach R show numerous fine fat droplets in the cytoplasm of the giant-cells, located for the most part within the smaller vacuoles. The large vacuoles contain particles of blood pigment, disintegrating red cells and the remnants of other tissue cells.

Giant-cells are not confined solely to the fibroblastic stroma, but are encountered in other parts; they are quite common, for instance, in the midst of massive hæmorrhagic areas and within dilated vascular spaces. Throughout the lesion, no matter where found, the giant-cells have the same general characteristics, which are those of the foreign-body type of cell. They are undoubtedly derived from the fusion of endothelial leucocytes proliferated from vascular endothelium. This idea is supported by the presence of scattered mitotic figures in endothelial cells, and also by finding scattered groups of two or three cells not yet entirely coalesced to form typical giant-cells. It is quite evident from a close study of the histopathology of the lesion that the opportunities for foreign-body giant-cell formation are excellent, and are due to a great extent to the large amount of *hæmorrhagic* granulation tissue. Another factor which contributes to the attraction of endothelial leucocytes and formation of giant-cells is widespread necrosis affecting particularly the extravasated areas and zones in the immediate vicinity. Large and small droplets of fat, within endothelial cells and without, are seen in great numbers, not only in the necrotic areas, but also in the better preserved portions of the lesion. This fat is derived from the extensive tissue necrosis. Moderate numbers of cells of the lymphocytic series, with occasional polynuclear leucocytes are found in and about the areas of necrosis.

Fibroblasts are numerous and are observed in all stages of development. Many of them produce narrow bundles of collagen fibrils, as may be demonstrated with Mallory's aniline blue connective stain. Fibroblastic proliferation is well advanced in the regions where

fibrin is abundant. Throughout the lesion, however, the fibroblastic tissue is young, and has not yet reached the stage of marked collagen formation with fibrosis, contraction, and cyst formation observed in "chronic fibrocystic osteomyelitis."

Sections from the bone in contact with the main mass show the following pathologic changes (Figs. 16 and 17): (1) Engorgement of the blood-vessels in the medullary spaces with perivascular hæmorrhages; (2) many endothelial leucocytes, phagocytic for blood pigment; (3) infiltration of the medullary fat tissue with lymphocytes, eosinophiles, and polynuclear leucocytes; (4) fibroblastic proliferation; (5) erosion of cortical bone and disintegration of bone trabeculæ by giant-cell osteoclasts. These latter are numerous where the resorption of bone is the most active.

Sections from the soft tissues limiting the mass externally show a reactive fibrosis which gradually passes over into vascular granulation tissue, containing foreign body giant-cells (Fig. 18).

Nuclear mitoses are *not* numerous, and are confined mostly to proliferating endothelial leucocytes.

REMARKS

From the standpoint of gross and microscopic pathology, the lesion, in its entirety, indicates a reaction to some injury — an inflammatory process of low-grade, chronic type. The injury inflicted might well be of a mechanical nature.

The histologic criteria employed in arriving at this conclusion and in differentiating lesions of this type from true tumor formations can be summarized briefly as follows:

(1) The heterogeneous cellular picture — fibroblasts, endothelial and polynuclear leucocytes, lymphocytes, and eosinophiles.

(2) Tendency to the formation of *hæmorrhagic* granulation tissue.

(3) The associated fibroblastic proliferation (regenerative).

(4) The absence of definite evidences of rapid autonomous cell growth as indicated by the scarcity of mitotic figures.

(5) The large number and character of giant-cells present (foreign-body type).

Inasmuch as the presence of giant-cells in medullary bone lesions of the type under discussion has been an important and prominent factor in diagnosis, it would seem advisable to determine what clinico-pathologic significance can be attached to the finding of giant-cells in such lesions. The question of giant-cell formation has been much debated by pathologists during recent years, and there still exists some difference of opinion as to their genesis, classification, and meaning. However, certain points have been brought to light which materially assist us in the interpretation of giant-cell reactions.

It is not necessary to enter into a discussion of this phase of the problem except to mention that for pathologic diagnostic purposes, it is desirable to divide giant-cells into two types[1]: (a) so-called foreign-body giant-cells, and (b) true tumor giant-cells. The first type has already been discussed; it is by far the commonest form of giant-cell. The second type is formed by rapid nuclear division, resulting in multiple mitoses and multilobulated nuclei, without complete division of the cell body. This type of giant-cell indicates rapidity of growth, and is found in a variety of *malignant* tumors.

The distinction between these two forms of giant-cells is not always easy; it may be complicated by such factors as poorly preserved tissue, thick sections, or indifferent staining.

The giant-cells in sections from Case 7 are so uniformly of the foreign-body type as to make their presence very significant and the interpretation of the lesion much simpler. The complete absence of true tumor giant-cells goes a long way toward explaining why it is that a lesion of this kind runs a comparatively benign clinical course.

Mallory[2] contends that the term "giant-cell sarcoma" should be given up as being inexact and confusing; there is much to support this contention in examining these lesions.

We are of the opinion that an intensive pathologic study (with an idea to giant-cell differentiation) of tissue afforded by bone conditions similar to the ones noted might serve to simplify and systematize our knowledge.

[1] Mallory, F. B.: Principles of Pathologic Histology, 1914, p. 273.
[2] J. Med. Research, 1911, xxiv, No. 2, 463.

THE PREVENTION AND TREATMENT OF PELVIC ADHESIONS[1]

By P. STRASSMANN, M. D., L. L. D., Berlin, Germany

ADHESIONS in the region of the pelvic peritoneum involve the surroundings of the uterus and its appendages, the pelvic colon, the omentum, and the bladder. Adhesions are most frequently found in the pouch of Douglas, which is the deepest point of the peritoneal cavity and thus serves as a cesspool, into which effusions and other inflammatory products drain. The appendages of the uterus form the lateral and superior boundaries of this pouch. Adhesions around the bladder, anterior to the genital organs, are more rare, for the alternate filling and emptying of the bladder serves to smooth them away by mechanical action.

The importance of pelvic adhesions lies firstly in the *pain* which they produce; secondly, in impairment of *function*, chiefly of the genital organs, but which also involves the neighboring organs. The most noticeable symptoms are lower abdominal and lumbar pain, painful defecation and coitus, and not infrequently gastric pain, especially if we have to deal with omental adhesions, which are always difficult of recognition. In such cases the tongue and gastric contents are unaltered. Later menstrual disorders appear. These are caused by stretching of the adhesions as a result of the menstrual swelling of the uterus. This may in part be attributed to ovarian pain, since the adhesions check the maturation and rupture of the follicles and render free extrusion of the ova impossible. Should the tubes be involved in the adhesions, pain will be present at other than menstrual periods in the form of retention colic and stricture pain. Finally, these women are frequently sterile.

A. *Adhesions may occur as the result of bacterial infection*, which may find its way (*a*) *through the tubes*, e. g., gonorrhœa and puerperal infections; (*b*) *through the wall of the uterus*, first, by way of the lymph-channels, as may occur in puerperal sepsis; second, direct, e. g., following perforation by sounds; (*c*) by way of the appendix, abscesses of which readily gravitate to the pelvis. If cases showing severe inflammatory changes in the appendix are not operated upon in time, the result may be suspended fertility and incurable adhesions in the pouch of Douglas. (Tuberculosis diseases do not come within the scope of this paper.)

B. *Adhesions may arise from effusions not in themselves infectious*, e. g., hæmatoceles and hæmatomata. Adhesions here are protective elements which check hæmorrhage and limit the further extension of the products of effusions. This is nature's treatment and promotes the organization and absorption of the blood-clots. In reality this type of healing by "*encapsulation*" is frequently followed by worse results than would be the case after surgical removal, since the proper artificial emptying generally leaves fewer adhesions. In cases of tubal pregnancy, operation restores the fertility far better than does spontaneous absorption. In cases of tubal rupture, pregnancies follow operative treatment much more frequently than they do after spontaneous absorption.

C. *The third group is due to mechanical causes.* (1) Friction of tumors, chafing, etc. Ovarian tumors are intraperitoneal formations which can develop freely in the abdominal cavity. Malignant tumors are more frequently followed by adhesions than either the benign type or ascites. Adhesions due to benign tumors keep pace with the increased growth. Adhesions may also follow unskillful use of the trochar. Intraligamentary growths give rise to fewer adhesions.

Dermoids and teratomata even when small injure the peritoneum through the foreign nature of their contents. This is of great importance. Adhesions to the intestine allow the bacillus coli communis to penetrate the dermoid sac and thus lead to infection and suppuration of the tumor.

Necrotic tumors and *strangulated* tumors with injured pedicles give rise to still more serious adhesions. Even a strangulated

[1] Delivered before the Anglo-American Medical Association of Berlin, August 16, 1913. Translated from the German manuscript for this publication by Dr. F. B. Mawbray.

tumor may exceptionally retain its nutrition; e. g., when it is enveloped by omentum.

(2) Myomata, as is well known, rarely give rise to adhesions. When well nourished, they are invested with smooth peritoneum. The only myomata capable of producing adhesions are of the subserous variety, those undergoing necrosis as a consequence of a twisted pedicle, or the same presenting infarcts or the results of intestinal infection.

D. *Undoubtedly, even healthy organs when displaced can produce adhesions.* Retroflexed uteri may exist for years without adhesions, and even here in many cases these should be attributed to infections. However, adhesions may arise without infections—that is to say, *first,* due to the pressure of an ill-fitting or incorrectly placed pessary; *second,* through the development of small myomata; *third,* through the agency of ovarian hæmorrhages. The clinical picture and the symptoms of retroflexion are primarily referable to the torsion of the ligamenta lata. This produces a varicocele in the broad ligaments, the ovary becomes hyperæmic and follicular hæmatomata result, with more or less effusion of blood and fixation. This also applies to gynatresia, in which the aseptic contents of hæmatosalpinges and hæmatovaria produce adhesions.

E. *Prolapses* are rarely responsible for adhesions.

The dangers of pelvic adhesions are easily overestimated. Certainly a fixed retroflexion forms the second stage of a dislocation, which can now no longer be treated with a pessary. On the other hand, adhesions may favorably influence operative measures inasmuch as they serve to localize the operative field.

Ileus is a rare complication, for the small intestines lie well above the pelvic organs. Omental adhesions of themselves are scarcely able to produce strangulation. Pelvic adhesions and those involving the colon may easily interfere with intestinal function but they never give rise to obstruction.

It is not my intention here to speak of tumors, nor even of large pus-tubes, but I shall confine myself solely to the results of adhesions with organs, which in themselves are very little altered.

The kinking of the tube, inasmuch as it obstructs the passage of the ovum, may be considered as the greatest causative factor of tubal pregnancy.

Strong bands, which stretch over the ovary, may produce deep furrows or may even constrict a part of the gland. A firm web around the ovary may embed it in a real fibrous envelope, from which it must be freed by operation. It is quite conceivable that after such a freeing from adhesions ovulation and menstruation may be restored.

Nervous complaints, which generally accompany pelvic adhesions, deserve a word. They become especially noticeable when the local significance of the conditions is not sufficiently appreciated and the physician is led to make a diagnosis of nervousness and hysteria. Naturally the skin zone over abdominal organs is sensitive and the ovaries respond in the same way as the appendix, kidney-pelvis and gall-bladder. Every person with chronic peritoneal adhesions becomes irritable and eccentric. The diagnosis "ovarie" is far too often incorrectly made; the same applies to "hysteria," which is only a symptom-complex accompanying physical or psychical diseases. Both frequently manifest themselves in the region of the genital organs. They are either functional or really organic and at times painful and inflammatory. When the physician neither discovers nor recognizes the real cause, then the complaints increase, for the patient does not receive the correct advice regarding her mental or physical needs and the proper aid is denied her. Many years ago the diagnosis "hysteria" alone disappeared from my books. I see in the word "hysteria" nothing more than the Greek name for unrecognized conditions, against which the physician has not yet found the power either to advise or help.

It is quite comprehensible how women with unalleviated pain of long standing can be driven to suicide; and Bossi is right when he says that the cure of a painful disease raises the patient to a higher plane of mental equilibrium.

For the prevention of adhesions the avoidance of genital diseases is indicated. Since this generally lies beyond our power, it

remains only for us to act so opportunely and correctly that changes in the parametrium and peritoneum cannot occur. Even here we are to a certain degree limited. For we know that *adhesions* in many cases are *consequences*, which one may not disturb with impunity. The agglutinated mass, e. g., consisting of uterus and adnexa, forms a protecting barrier against the spread of the infection to the general peritoneum. Sad are the results when the sticky protective adhesions consequent upon a recent gonorrhœa or puerperal infection are too soon broken up. A violent peritoneal reaction follows, which means that there is a renewed and greater effort to again encapsulate. It can be just as fatal when a recently infected uterine appendage is removed by abdominal section. Here a general peritonitis often follows the unavoidable flow of pus into the abdominal cavity. In such cases the reference to an "old gonorrhœa" or the statement that "everything was previously infected" may pass current with the laity. But from the standpoint of a conscientious medical man it is not sufficient. *Cellulitis*, *stump exudates*, *omental adhesions*, and even *ileus* militate against the success of the operation. Although the patient may recover from the operation, still the complaints continue. Discontent, nervousness, eventually hysteria, and finally perhaps attempts at suicide result.

For many patients, timely operative intervention is the best course to pursue in order to preserve functionating genital organs or to avoid changes leading to disability, despair, and nervous disturbances.

The acute inflammatory diseases of the adnexa may indeed abate in a few weeks, but they often lead to relapses and to highly dangerous forms, as for instance after criminal abortion, when the violent early symptoms of a beginning general peritonitis demand prompt relief. The inflammatory products must have another outlet in order to secure quick healing if possible, and secondly, to avoid the formation of abscesses in the tube and ovary and perhaps a lingering illness. The opportune opening of the posterior fornix and drainage of the pouch of Douglas is far too seldom employed. It is not a dangerous procedure and should be undertaken in the above-mentioned cases just as paracentesis of the ear-drum is done for middle-ear inflammation. It has proved in various cases of pelvic peritonitis following artificial abortion to be a life-saving measure and has many times prevented the formation of large tubal abcesses. I can heartily recommend it as a simple, harmless procedure which promises every success.

Of greatest importance in the formation of adhesions is excessive intra-uterine treatment by means of curetting, local applications and douches, in cases of gonorrhœa or puerperal infections. Also the forcible correction of displacements by sounds, being a cause of adhesions, must be condemned. Perforations of the uterus occur much more frequently than is commonly believed, which fact is well known at all great clinics and hospitals. Moreover, in uteri of patients who were not aware of inflammatory processes, a stellate scar is not infrequently found on the fundus or posterior wall during operations for retroflexion—a sign of a previous but fortunately aseptic perforation.

Inflammations of the appendix demand timely operation and cases with pelvic abscess should be drained through the posterior fornix. The fact that chronic inflammations of the appendix, especially in women, should be operated upon and not left to themselves needs only to be mentioned here.

I maintain that hæmatomata in the pelvis should be emptied on principle, and moreover through the vagina, since this is the natural outlet of the pelvis. This includes not only hæmatomata resulting from tubal pregnancy but also hæmatomata of the ovary. The diagnosis of these is not easy and one should always think of them in obscure cases. If in retroflexed uteri adnexal swellings with pain occur, if near a myomatous uterus sensitive nodules are to be felt; and if with this newly formed resistance no fever exists, then we have to deal with hæmatomata.

Small growths of the ovary should never be overlooked. This applies especially to small dermoids, since adhesions involving these and giving rise to the diagnosis "oöphoritis and

parametritis posterior, etc.," are not rare. The conservative treatment of such "chronic inflammation" with baths, etc., amounts to positive negligence.

The history of a previous gonorrhœa of the husband too easily distorts the view of the physician. I venture to say that a man without symptoms, even when urethral shreds are still present, can no longer produce pyosalpinges or severe inflammations of the adnexa. I must further maintain, according to my experience, that the transference of acute gonorrhœa to the female from a symptomless old gonorrhœa of the male is exceedingly rare. Dermoids in childbed are occasionally recognized too late and, therefore, neglected. It is too easy to look for the ghost of infection, while the strange intruder (the tumor growing from the ovary or uterus) is overlooked.

Myomata. In patients with myomata the onset of fever should always cause one to think, first, of a necrosis or softening of the tumor. The X-ray is of no avail here. One should not forget that pyosalpinges can occur with a myomatous uterus. Observation and experience must tell the surgeon whether he can treat them conservatively or whether he must operate upon the pus-tubes resulting from these tumors. Adnexal suppuration arises from hard calcareous tumors just as suppuration in the gall-bladder or kidney pelvis is caused by prolonged pressure of stones.

Only those retroflexions which are free from adhesions and correctly replaceable may be treated by pessaries. The pressure of the pessary against the uterus lying between the folds of the pouch of Douglas leads first to pain, which denotes the beginning of adhesions. Whether or not a uterus is free from adhesions cannot with certainty be determined. The uterus, which is not replaceable without narcosis, is frequently free from adhesions, while the replaceable and movable one may show long membranes, which are stretched from the posterior wall and appendages to the rectum. Any operation for retroflexion, which does not permit of a full view of the organs and of the deepest point of the pouch of Douglas, from this fact alone is always of questionable utility. Therefore, the Alexander operation is a lottery with many blanks. The freeing of the smallest adhesion is of more importance than this or that "modification" for the fixation of the uterus. Even small myomata which can be mistaken for the retroversion, or may be responsible for it, may without such clear view be entirely overlooked.

We have now come to the treatment of adhesions, and I shall complete what has not already been discussed in the foregoing. We have to consider the timely removal of growths and swellings, abstaining from operation in recent inflammatory processes, and the more frequent use of the paracentesis of the posterior fornix and the pouch of Douglas. The most important resorptive treatments, namely, douching, tampons, heat baths, etc., are only mentioned; where these are helpful, the parts should be left alone. Only the chronic painful adhesions of the organs shall concern us.

A. Spontaneous healing and restoration of function depends upon the extent of the adhesions. This we see in cases of artificial adhesions, which we attempt to produce in retroflexion operations, varying in all stages from a relaxation of the artificial peritoneal attachments to stretching into long bands or even completely breaking. Adhesions may atrophy, tear apart, and from the movements of the abdominal contents be worn out by friction. A healing factor is the advent of pregnancy. That such may happen in cases of adhesions is certain, and pregnancy can also be carried to full term. I have seen in a cæsarian section, where no abdominal operation has been done before, a uterus covered entirely over with adhesions twenty to thirty cm. long. Stretching leads to the disappearance of the adhesions or at least to the pain which they produce. Even tubal pregnancy may favorably influence an old adhesion. Quite often we meet with the following history: inflammatory abdominal disease, adhesions, sterility of long duration; finally conception, tubal pregnancy necessitating operation, thereby freeing of adhesions, and now soon afterward intra-uterine pregnancy with a living child.

In a fixed retroflexed uterus a pregnancy does not lead to a cure, but generally ends in abortion. But there are exceptions.

Stretching and smoothing out of the adhesions may be attempted as a healing measure by means of massage, though this method being tedious and disagreeable has been at present discarded; but not rightly. This is best adapted, however, to cases of anteflexed uteri and is applicable only in the absence of pus-tubes.

B. The replacing and freeing of the uterus and adnexa in narcosis according to the method of Bernhard Schultze and the introduction of a pessary for many patients, whose most recent inflammation is long since passed, is even to-day indicated. We have discarded the method in favor of our operation, which owing to its ease and simplicity is to be preferred as a safer method, if the patient should require an anæsthetic.

C. Patients suffering from adhesions do not readily consent to operations involving laparotomy, nor does the physician, as can be readily understood. Abdominal section under very best conditions impairs the continuity of the abdominal wall; the operation necessitates handling of the omentum and intestines, the exposure of individual intestinal loops and the entrance of air, especially in the Trendelenburg position. New adhesions may form in many cases in locations, which were previously free therefrom, as shown daily in office practice. In these cases we should resort to vaginal operation, which in cases of perimetritis and chronic perioöphorosalpingitis is far more conservative than abdominal section and possesses other advantages; viz., its ease of application, and the patients' ready consent. Fixed retroflexions, which result from old healed inflammations of the adnexa, are better operated vaginally, the Douglas folds being more readily seen. Unless special indications—such as appendix complications—demand it, the vaginal route —being less dangerous—alone is justified. Intestine and omentum are scarcely disturbed, but only pushed upward and at the worst a few adhesions are separated. The genital organs are now freed of adhesions, the pouch of Douglas smoothed out, and the appendages are brought forward, the ovaries stripped free, and finally the tubes may be opened and probed; the omentum is pushed aside and the bladder wall easily exposed to view. Whoever would learn this technique is advised to begin with women who have borne children, following this with women who have cohabited and are sterile, before attempting the operation on virgins. In order to hold the uterus securely forward, a union of the anterior surface of the uterus to the bladder peritoneum and a proper treatment of the vesico-uterine folds is necessary. Should one find fresh inflammations or bleeding adhesions, then drainage through the pouch of Douglas acts as a safety valve. Adnexa operations by the vaginal route sometimes give rise, it is true, to stump exudates, but they disappear far more quickly than after laparotomy. Ileus is more rare. Inflammations following operations on dirty cases (from tubal contents) may indeed occur, but their course is much more favorable than that following laparotomy. This procedure does not contribute to the formation of new adhesions in the abdomen.

Absorbable suture material should be used. Catgut should not be impregnated with iodine. Good hæmostasis and drainage bring complete success and prevent the return of symptoms, especially those due to new strong bands or membranous adhesions. Spongy agglutinations will, of course, always be found on sites disturbed by operation.

Neither for *fixation of retroflexions, chronically diseased appendages, the majority of tubal pregnancies, hæmatoceles, nor hæmatomata is an abdominal operation required.* Also many tumors should and must for this reason be operated upon *vaginally*. Adhesions follow the abdominal route much more frequently than the vaginal. Just as we are in a position to operate upon and extirpate kidneys retroperitoneally, so should we learn to become proficient in operating and curing, without abdominal section, diseases which manifest themselves essentially by pelvic adhesions. By practice one learns how to expose the vagina and obtain a broad operative field. In operating the surgeon takes advantage more and more of the

elasticity of the ligaments in order to draw the organs downward. Only the part which at that time will be operated upon need be drawn forward. In operations on a tube or ovary it is not advisable to continuously pull or hold forward the body and portio of the uterus.

Operating vaginally without the Trendelenburg position is an enormous advantage, since, thereby. the entrance of air into the abdomen is practically excluded.

I concede, in the first place, that the vaginal route does not appear so simple for the operator, and certainly everything cannot be done by way of the vagina, but the abdominal route is more dangerous and is followed by more disturbances. The patient will much more readily consent to an operation which does not necessitate abdominal incision and thus we will be in a better position to cut short the illness and insure a favorable outcome.

The removal of the consequences of chronic pelvic adhesions without injury to the abdominal parieties is one of the greatest tasks of gynecology. The vaginal route renders this possible. At the present time we can say that any interference with the abdominal organs is only very exceptionally indicated. With this end in view we travel the same path as Nature does in her efforts to heal pelvic disorders; by insuring healing of the diseased pelvic organs and their complete isolation from the abdominal cavity.

ARTERIOVENOUS (VARICOSE) ANEURISM OF THE DEEP EPIGASTRIC ARTERY AND VEIN[1]

Report of a Unique Case with a Review of the Literature

By M. J. SEIFERT, M. D., Chicago

DEFINITION: Arteriovenous aneurism is an abnormal communication between an artery and a vein, through which blood circulates. There are two varieties of arteriovenous aneurism: (1) The *aneurismal varix*, in which there is a direct communication between the artery and the vein; (2) the *varicose aneurism*, in which the artery and the vein communicate through an intermediate sac.

In the most simple form there is merely an arteriovenous fistula, although usually the vessels about the aneurism are more or less dilated (Fig. 1). Then, there may be, besides this fistula, a sacculated artery (Fig. 2), a sacculated vein (Fig. 3), an intermediate sac (Fig. 4), or a combination of these conditions (Figs. 4, 5 and 6). It is more common to find the vein sacculated than the artery.

History. It is an error to credit Sennert with the discovery of arteriovenous aneurism, for, although this author was the first to record the exact symptoms of the lesion, he believed and maintained that it was the ordinary aneurism he was describing. Clinically, the history of this remarkable discovery begins with the first accurately recorded case by William Hunter, in 1757, who established the existence of arteriovenous aneurism without autopsy, simply by carefully analyzing the symptoms, Le Dentu et Delbet (1).

Delacombe, in 1761, published an anatomical description of arteriovenous aneurism based upon the post-mortem study of a lesion implicating the femoral vessels, Broca (2).

The first scientific account of arteriovenous aneurism of the subclavian vessels dates back to the classical case of Sargent Pierre CaDrieux, whose injury was treated by the distinguished Dominique J. Larrey (3) in 1829 and made memorable by his admirable paper in the "*Cliniques Chirurgicals*," Paris, 1829.

Etiology. Arteriovenous aneurism arises most frequently as the result of an injury which opens an artery and a vein at the same time. In the days of venesection, the unskillful use of the lancet frequently caused the simultaneous incisional injury of the brachial artery and the median basilic vein, thus producing an arteriovenous aneurism. At the present time it is less common in this location, but is occasionally found in such regions as the neck, axilla, groin, and the extremities. Bullet and stab wounds are the usual causes. Cases are on record in which an arterial aneurism has ruptured into a vein, thus producing an abnormal communication between the two vessels. In others, it appears that the aneurism has occurred spontaneously in diseased arterial and venous walls, Johnson (4).

Fractures are known to have caused arteriovenous aneurism at the base of the skull; bone fragments wounding simultaneously the internal carotid artery and the cavernous sinus. The spontaneous variety generally occurs in the aorta; sometimes the communication is with the pulmonary vein, or, in case the abdominal aorta is affected, with the inferior vena cava.

Matas (5), in 1901, made an analytic study of fifteen cases of arteriovenous aneurism of the subclavian vessels, including one of his own. These cases were collected from all sources of the literature. They were all of traumatic origin; nine were caused by stab or penetrating cut wounds, the other six by bullet wounds. All the cases were in men, none exceeding the middle age.

Pathology. The inception of arteriovenous aneurism usually is traceable to "first aid" treatment; i. e., to the firmly laid compress over the causative wound, placed for the purpose of arresting hæmorrhage. In the healing of such a wound the inflammatory reaction causes the vessels to adhere to each

[1] Read before the Chicago Medical Society, January 21, 1914.

other. The wound through the vessels does not heal, however, on account of the constant flow of blood through the openings. The arterial blood thus projected into the vein eventually dilates the latter. There is some alteration in the coats of the vessels, but none that would offer restraint to the circulation of the blood as in arterial aneurism. The vein is generally dilated, but not enough to cause rupture. The veins beyond the varix are nearly always more or less dilated and enlarged. Varicose aneurism usually forms when the wound causing the aneurism remains untreated, or if the compress placed for arresting hæmorrhage does not exert sufficient pressure. In such cases blood will extravasate between the walls of the artery and the vein, separating the two vessels. Inflammatory lymph deposited around the space will organize and a false aneurism is formed communicating with both vessels. The sac in such a case consists of condensed effused lymph. On account of the slight arterial pressure affecting the walls of the sac of a varicose aneurism, the sac, as a rule, is not subject to much enlargement. In an ordinary aneurism the force of the blood current impinges directly on the aneurismal sac; but in the varicose aneurism the blood current finds its way through the aperture into the vein; thus its force is distributed, instead of being directed against the walls of the sac. While enlargement of the sac is not common, yet in view of the liability of the sac to slough, and the danger of gangrene of the limb, or of the false aneurism to become diffuse, the indication for surgical interference is plain.

Diagnosis and symptoms. The symptoms of varicose aneurism and of aneurismal varix are nearly identical, with the exception of the presence of the sac in the former. The sac can, in some cases, be recognized by palpation and by a soft bruit. The symptoms of arteriovenous aneurism vary according to the location and the relative size of the vessels involved. If the artery is small and the vein large, so that the additional flow of blood can readily be disposed of, the symptoms may be slight or entirely absent. If, on the other hand, the artery is large and the vein small, the vein and its branches become enlarged, varicose, and tortuous on the distal side of the abnormal opening, and serious disturbances of circulation and nutrition may follow. The symptoms usually make their appearance early after the causative accident; characteristic signs are perceivable, a thrill can be felt, and a murmur heard by placing the stethoscope over the opening between the artery and the vein. The murmur is continuous and likened to the purring of a kitten or the noise of the blue-bottle fly when buzzing in the interior of a thin paper bag. The intensity of the rhythm changes, corresponding to the pulsations of the heart. The blood, as it enters the vein, comes in contact with the opposing venous stream and produces a whizzing sound which is pathognomonic of aneurismal varix; once heard, this sound will never be forgotten nor mistaken for any other condition. The varicosity of the veins may increase and become so extensive as to involve most of the superficial veins of the extremities. There are sometimes disturbances of sensation in the limbs, such as numbness, tingling, and neuralgic pains. The nutrition may be altered, and there may be weakness of the muscles, œdema, dermatitis, and ulceration of the skin. Makins (6) states that a striking symptom of both aneurismal varix and varicose aneurism is the accelerated heart action.

Prognosis. In some cases the disease is stationary; in others, it grows worse. There is no recognized tendency to spontaneous cure in arteriovenous aneurism; œdema is the rule; rupture of the sac may occur; muscular atrophy is common, and ulceration and even gangrene of the limb may supervene. Cases of spontaneous recovery, however, have been reported in the literature.

Treatment. Keeping in mind the tendency of varicose aneurism to ulcerate and become diffuse, radical treatment should not be delayed. Compression should not be practiced, as the already dilated sac and varicose veins would become more enlarged and finally cause a marked œdema and expose the patient to the danger of gangrene. The Hunterian operation of tying the femoral artery above the sac, in the healthy tissues, has been tried in two cases, and death followed in both

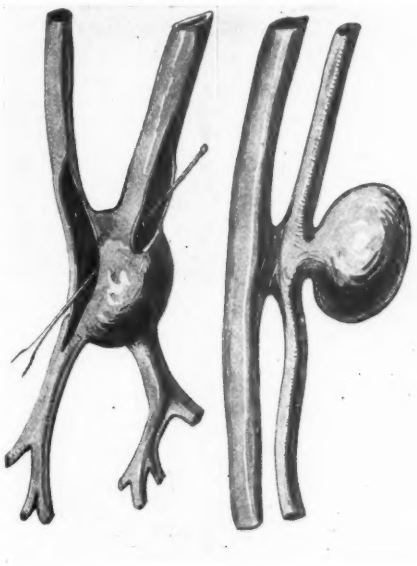


Fig. 1.

Fig. 2.

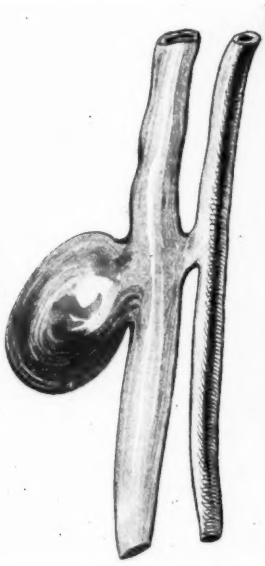


Fig. 3.

Fig. 4.

instances. The reason for the failure of this method is that the pathology of varicose aneurism is different from that of the ordinary aneurism. In the ordinary aneurism the ligation of the artery causes a deposit of fibrin in the sac on account of the lessened amount of blood slowly entering the sac. In varicose aneurism the communication through the sac with the vein offers an unimpeded passage of blood into the venous circulation. This prevents coagulation, for blood in motion does not coagulate.

Spencer's operation is to cut down to the artery and ligate above and below the sac without disturbing the vein or opening the sac. The application of these ligatures removes the morbid influence of the retrograde current of arterial blood, thus permitting the blood to coagulate within the sac, and hence the consolidation of the tumor. Matas' operations, extirpation or angeiorrhaphy, i. e., extirpative or reconstructive, are preferred, however, by surgeons at the present time, for both varicose aneurism and aneurismal varix. The aneurism should be exposed by dissection and, if not too large, ligatures should be applied to both vessels above and below the pathologic growth, and the latter extirpated. This is a well recognized operation. In cases of varicose aneurism of the neck, or of the anterior femoral region, this procedure would, however, be attended with a grave prognosis. In some cases of varicose aneurism the sac is excised and the openings in the vessels closed by sutures. Likewise, in some cases of aneurismal varix the adherent vessels are separated and the opening in each is sutured.

Some authorities contend that aneurismal varix should not be operated upon as long as it is not progressing ominously, is borne without inconvenience, and is not leading to complications. They advise that the patient wear a support. Should, however, the part become painful, or the danger of rupture be imminent, they claim operation should not be postponed. The writer does not subscribe to this principle any more than to the procrastinating policy of some physicians in their treatment of appendicitis.

In aneurismal varix of the carotid, the internal jugular, and of the common femoral vessels, operative interference should be undertaken only when extremely urgent, owing to the unusual seriousness of the prognosis.

Fig. 5.

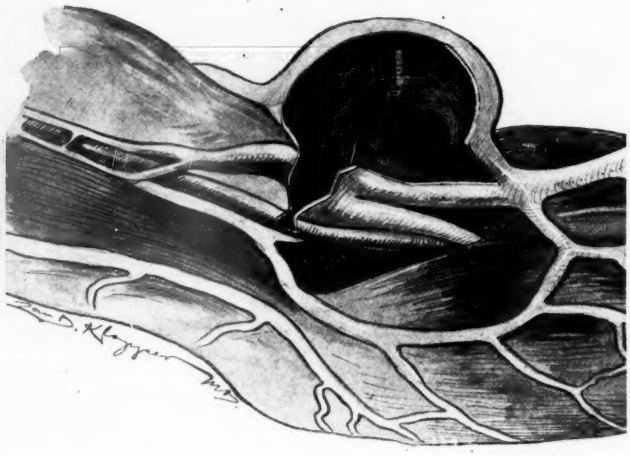


Fig. 6.

Stewart (7) recently reported an instructive case of aneurismal varix of the femoral vessels treated by angeiorrhaphy. This occurred in a boy three years old, during circumcision. While performing the operation the surgeon laid the scalpel on the left groin, the patient suddenly flexed his left thigh, impaling it upon the knife. A furious hæmorrhage resulted; this was controlled by enlarging the wound and applying ligatures to the femoral vessels. A month later a systolic murmur was found over the right heart, together with cardiac hypertrophy. On admission to the hospital four years later, a scar was found on the middle of the anterior surface of the left thigh. Over this a continuous thrill was felt and a bruit was heard; the latter was transmitted down the femoral vessels to the knee, and up as far as Poupart's ligament. Both thrill and bruit were reënforced at each arterial systole, and both ceased when firm compression was made over the scar. The veins were dilated and the limb cyanosed. Besides, the limb was an inch longer than the right, and half an inch greater in circumference, although there was no œdema. In operating, the femoral vessels were exposed above the scar and traced downward. The vessels were adherent for about half an inch, but there was no sign of any intermediate sac. The vessels were separated with a sharp knife, and the opening in each, about one-eighth inch in diameter, closed with sutures of fine silk. A flap of the vastus internus was passed around the artery so as to form a canal and separate it from the vein; the wound was closed and the limb placed in a splint applied loosely to the root of the thigh so that in case of hæmorrhage the nurse could at once control it. The pulse at the foot reappeared as soon as the blood current was turned on. The murmur of the heart disappeared and the organ diminished considerably in size. The patient was discharged ten days after the operation.

As to treatment, separation of the vessels with excision of the sac, if such there be, and suture of the opening in the artery and in the vein, is an ideal method in all cases in which the major vessels are involved, and in which the operation is possible. Extirpation of the aneurism after ligation of both artery and vein, above and below, is the only rival of

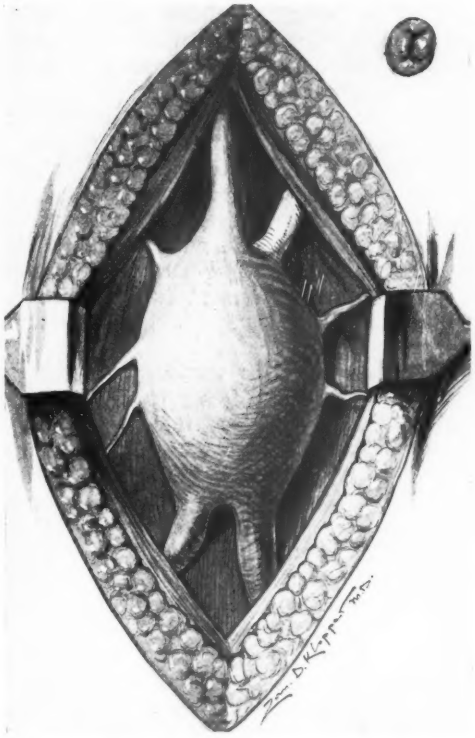


Fig. 7. Varicose aneurism of the deep epigastric vein and artery.

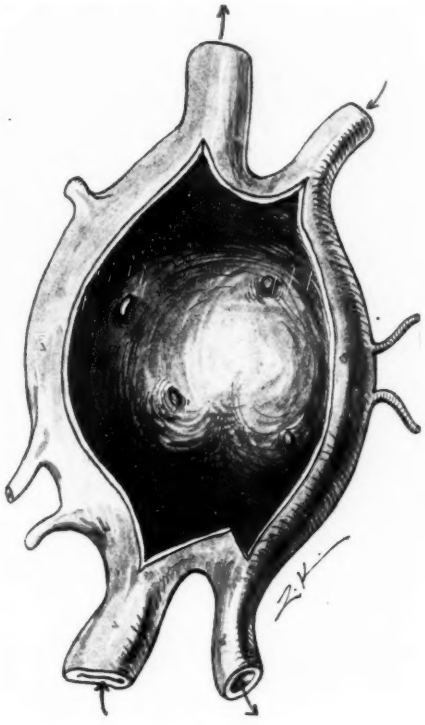


Fig. 8

angeiorrhaphy, and is to be preferred since it precludes recurrence and is rarely followed by gangrene.

In 105 extirpations for arteriovenous aneurism taken from Delbet, Monod and Vanverts, 99 cases were followed by recovery, four by death, and two by gangrene, one case of gangrene being due to ligation for secondary hæmorrhage.

Stewart (7) gives the following tabulation:

Ligation of the subclavian artery causes gangrene in 2 per cent of the cases (von Bergmann); axillary, 6.6 per cent; brachial, 18.75 per cent.

Ligation of the common femoral artery causes gangrene in 20 per cent of the cases (Raabe); femoral artery and vein, 48.3 per cent (Ziegler); femoral artery and vein, 60 per cent (von Bergmann); popliteal artery, 54.5 per cent (von Bergmann); popliteal artery and vein, 100 per cent (von Bergmann).

The following report on the occurrence of arteriovenous aneurism was taken from Le Dentu and Delbet:

In the foot. Extremely rare. In 1895 only two cases could be found. Johnson's case reported by Cooper, in which the aneurism occurred spontaneously in the internal malleolar vessels.

Cadges' case developed in the stump at the tibiotarsal articulation. A third case by Rhode is doubtful as to its identity.

In the leg. Not so rare. Often found in stumps. It occurs most frequently in the posterior tibial vessels.

Monod and Vanverts collected fourteen cases. Of these, seven were in the posterior tibial vessels, two in the peroneal, one each in the posterior tibial artery and anterior tibial vein.

Fig. 9.

Gross and Sencert have observed one case that followed fracture of the limb. In thirteen cases extirpation was successful. In one case extirpation was done, infection set in, gangrene followed, the limb was amputated, and the case recovered. Physick ligated the femoral vessels in a case, which resulted in gangrene and death. Nicolaysen cured one case by ligating the posterior tibial vessels and the peroneal artery.

Annandale and Maydl cured one case by incision of the sac. One case was treated by galvano-puncture, without success.

In the popliteal space. Not very rare. In 1889 Le Dentu and Delbet collected 22 cases: two of spontaneous origin, one from rupture of an arterial aneurism into a vein, the other by exostosis; all the others were of traumatic origin.

Monod and Vanverts collected 35 cases recently, and in every case of which the etiology was known, it was of traumatic origin, usually caused by bullet or stab wounds. The branches of the popliteal vessels are most frequently affected, the tumor usually attains a large size, and the veins of the limb are extremely dilated. Trophic disturbances are common, and ulcers are frequent. The œdema sometimes is enormous. In some cases there is violent pain due to pressure on the sciatic and the internal popliteal nerves. It is a serious condition and requires prompt treatment. Compression has been tried in all its forms without success. It is, however, of some service preparatory to an operation as it lessens the œdema, favors the nutrition, and the healing of ulcers. Extirpation is actually the best method of treatment, although bad results may follow, such as gangrene and functional disturbances.

In the superficial femoral vessels. This is now among the most frequent of all forms. Le Dentu and Delbet collected 34 cases in 1895. Monod and Vanverts have collected 35 cases since. Most cases in this region are of traumatic origin. Berry reported a case of spontaneous origin. These cases should be treated promptly, as œdema, engorgement, and ulceration are usually present. Double ligation with extirpation has given the best results.

In the root of the thigh. Almost as frequent as in the femoral vessels, bullet and stab-wounds being the usual causes.

In 1889 Le Dentu and Delbet collected 26 cases. Monod and Vanverts have collected 23 cases since. The symptoms are the usual, but treatment of these cases is most delicate. Ligation by the method of Danell, and by that of Hunter before 1889, gave the most disastrous results. Out of 11 cases, 9 died, and 2 were cured by ligation of the artery and vein. The double ligation has usually been successful, but extirpation is the method of choice. Practically, this method has been successful in all 12 cases reported the last twenty years.

In the iliac vessels. This is extremely rare and unless treated immediately, is almost always fatal. Three cases of the internal iliacs have been found, but all ancient. Laney's case is somewhat doubtful. Crisp's case was a diffuse aneurism. Bergmann's case was gangrenous and had to be amputated.

In the common iliacs it is still more rare; only two cases are on record. Extirpation is probably the best treatment in these cases after the sac is found.

Retropelvic. Only one case has been reported, that of Ribers, already very ancient. It is plain that in a region in which anastomosis is so frequent, the only thing to do is extirpation.

In the forearm and hand. Very rare. Monod and Vanverts collected 5 cases, all of which were treated and cured by extirpation. It may affect any of the vessels of the forearm. They have all been of traumatic origin. In Bazy's case the interosseous vessels were affected.

At the bend of the elbow. Common in the times of venesection, not very frequent since. Le Dentu and Delbet collected 96 cases in 1889. Monod and Vanverts have collected 8 cases since. These cases almost always occurred between the humeral artery and the median basilic vein.

In the humeral artery. Rare. Eight cases were found in 1889. In 1909 two more cases were found.

In the subclavian artery and its branches. Plyette and Broman collected 19 cases; 9 were caused by piercing instruments; 8 by bullets; 2 by fracture of the clavicle — all in the third portion of the artery. No spontaneous cases were reported. These cases must be treated early, otherwise they are fatal on account of profuse hæmorrhage and hæmatoma.

In the common carotid artery and the internal jugular vein. Le Dentu and Delbet collected 19 cases in 1889. Monod and Vanverts have collected 11 cases since. All were of traumatic origin, except one by Queirel, which was spontaneous.

In the external carotid artery. Rare. Le Dentu and Delbet found only 3 cases in 1889. Two of these were treated but without success.

In the internal carotid artery. Extremely rare, only one case on record; operated three years after accident by Keen, followed by recovery. The prognosis, however, is bad.

In the head and face. Le Dentu and Delbet found 11 cases affecting the superficial temporal, one the occipital, and two the facial artery.

Monod and Vanverts collected 4 cases, two of the temporal, one of the occipital, and one of the internal maxillary artery. In the line of treatment, double ligation with extirpation has given the best results.

In consideration of the aforesaid, the author feels called upon to report a unique case of varicose aneurism of the deep epigastric artery and vein, occurring in his service at the St. Mary of Nazareth Hospital, Chicago.

Case Report. Mrs. J. S., of Stacyville, Iowa, aged 43, housewife, German. Family history unimportant. Personal history negative until married. Full term deliveries three times; six miscarriages, involuntary. Always well up to the birth of the first child, at 23; the child weighed 13½ pounds, and delivery was instrumental. She has been suffering with pains in the back and legs, and has never felt strong since this labor. She is subject to constipation. Eczematous dermatitis four years ago. Present illness dates back about eight years, when she was delivered of twins in the eighth month of gestation, both fœtuses being dead and bearing evidence of having been dead for some time. Puerperal infection followed, and the patient was in bed for nine weeks. A varicose condition of both legs dates back to this time. The deep veins were involved; there were no varices visible, but several varicose ulcers appeared below the knee and about the ankle on the right leg. There was a much milder display of the same condition on the left leg. The ulcers responded promptly to proper treatment, but would naturally recur when patient was up and attending to her daily duties. One year later the patient was operated for laceration of the cervix uteri. Following this operation the patient has been suffering pains in the right iliac region; these pains were more pronounced on pressure. While walking, patient would often try to support this region with her hand. When ironing, patient would kneel on a chair with right knee. Patient found it easier to carry things with the left hand, although she was not left-handed. She was neurasthenic, depressed, languid, and not interested in events, socially or otherwise, that would engage the attentions of her family. Patient was a victim of insomnia for eight years. At times would awaken at night "all stiff and bathed in sweat." At such times she had violent palpitation of the heart and a nauseating vertigo. During these eight years the patient had been examined by a number of doctors of prominence and by some of international reputation. All reported negative findings to the great disappointment of the patient and her family. All stigmatized her as an hysteric, claiming her ailments were imaginary. And all this time the patient suffered the symptoms described as above, to say nothing of her mental state upon being told time and again that she was bothered with imagination.

The patient consulted the writer August 1, 1910, and in addition to the above history, the examination revealed a moderate glycosuria; specific gravity

1031, and a slight albuminuria. After a month's treatment the urine was normal.

September 28, 1910, the patient was admitted to St. Mary of Nazareth Hospital, Chicago, was given treatment for varicose ulcers and, after these were healed, a preliminary course was instituted, preparing her for operation, as she was very corpulent, and had a large and pendulous abdomen.

October 24, 1910, patient was operated by the writer. A right rectus incision was made. After the usual dissection, cutting through five inches of fat, a varicose aneurism of the deep epigastric artery and vein (Figs. 7, 8 and 9) appeared. The sac between the two vessels was the size of a goose-egg; the vessels above were dilated to about three-fourths inch in diameter, and below to about one-half inch. The entire mass was about seven inches long. Double ligatures were applied to the vessels above and below and the mass was extirpated. There were ramifications of vessels in almost every direction, as after the removal of this mass a number of minor vessels had to be ligated before the hæmorrhage was controlled. Following this the appendix, the right ovary and tube, and a mass of varicose veins in the right broad ligament were excised. The appendix was inflamed and intimately adherent to the right ovary and tube; there were inflammatory bands almost completely encircling the caput cæcum. The incisions were closed by sutures in the usual manner, but a drain was placed in the abdominal wall to take care of fat necrosis. The patient made an uneventful recovery and has been in excellent health ever since, now a little over three years. Patient says she never felt so well before, takes interest in everything, attends social and other functions common to a farmer's wife and says she enjoys life.

This case is interesting and instructive on account of the uncommon location of the varicose aneurism, the symptoms that baffled some of the best observers, the successful outcome of the operation, its occurrence in a woman, and without a history of traumatism other than that pertaining to instrumental delivery while in labor. It is the only case of the kind on record, as a thorough search of the literature has failed to reveal a single parallel case.

Possible causes. Trauma incidental to pressure on the abdomen during instrumental delivery, followed by puerperal infection. Diseased vessel-walls through which infected blood may have extravasated, forming an infective clot, and then ulcerated into the vein. An infected embolus or thrombus ulcerating through the original vessel into another.

Medical problems. Is the theory tenable that an infected blood clot *per se*, either within the vessels (emboli or thrombi) or outside the vessels in the perivascular tissues (extravasations from the tissues, etc.), by ulcerating into one or more blood-vessels, may form an arteriovenous aneurism? Might the increased blood pressure incidental to labor plus the trauma of instrumental delivery cause this condition?

What is there to offer in the prophylaxis of arteriovenous aneurism?

BIBLIOGRAPHY

1. Le Dentu et Delbet. Noveau traité de Chir., Par., 1911, xl, p. 227.
2. Broca, P. Des Aneorysmes, Paris, 1856.
3. Larrey, Dominique J. Clin. Chir., Par., 1829, iii, 115.
4. Johnson, A. B. Surgical Diagnosis, i, 332.
5. Matas, Rudolph. Traumatic Arteriovenous aneurism of Subclavian Vessels, J. Am. M. Ass., 1902, Jan. 11.
6. Makins. Surgical Experiences in South Africa. Am. B. of Surgery, ii, p. 134.
7. Stewart, F. T. Arteriovenous Aneurism, treated by Angeiorrhaphy, Ann. Surg., Phila., 1913, lvi.
8. von Bondsdorff, H. Arteriett. Ven. Aneur. pa laret. Finska läk. sällsk. handl., Helsingfors, 1895, xxxvii.
9. Maher and Shirving. Case of Arteriovenous Aneurism, Australas. M. Gaz., 1910, xxix.
10. Greiss, W. R. Arteriovenous Aneurism. Lancet-Clin., 1912, cvii.
11. Drennan, F. M. Traumatism of Arteriovenous Aneurism of Aorta and Superior Vena Cava, Tr. Chicago Path. Soc., 1909, viii.

TARSALGIA

By WILLIAM JACKSON MERRILL, A. B., M. D., Philadelphia
Instructor in Orthopedic Surgery, University of Pennsylvania; Assistant Orthopedic Surgeon, University Hospital; Assistant Orthopedic Surgeon, Howard and Jewish Hospitals

MUSCLE weakness and the loss of muscle tone are the fundamental causes of most of acquired foot troubles. Depression in power and tone as a result of constitutional conditions, such as infection or intoxication, or both; prolonged fatigue and nerve exhaustion; and faulty nutrition and metabolism, when combined with severe trauma in a short period, or long continued slight traumata, will inevitably produce static disorders.

Normal muscle stress, which is necessary to maintain the upright posture in weight-bearing, becomes an abnormal muscle stress or muscle strain when the muscle for any reason has been depressed in power or tone. Normal muscle stress frequently gives rise to tenderness and pain in muscles owing to a toxic irritation of the muscle-cells. Weakness of isolated muscles or groups of muscles is frequently encountered and one must determine whether or not there exists isolated trophic disturbances or some peculiar developmental condition. In considering the perversion of function of normal structures, one must reckon back, from the pathological conditions which he has in hand, through the various steps in the mechanism which has produced it, to the normal for the individual under inspection.

Abnormal poise of the body as a whole, or any portion of it, as well as abnormal muscle balance, must be determined and compared with the normal for that individual if one would draw his conclusions correctly. If a muscle or group of muscles, working parallel to another muscle or group of muscles, for any reason is not performing its normal function, the correlative muscle or group of muscles is subjected to inordinate or abnormal stress, and since normal stress under abnormal conditions becomes strain, the muscles so imposed upon suffer injury.

Muscles which are forced to act between their abnormally approximated attachments shorten to accommodate function to the altered working distance. Normal muscles which are subjected to constant abnormal strain, lose resiliency and become flaccid, or develop conditions of rigidity or spasm.

The tendons of the long flexors of the toes as they pass around the os calcis add a considerable force in opposing pronation. If either of the tibials or both are depressed in power or tone, the long flexors of the toes are involuntarily stimulated to overaction, and naturally their opposing muscles are forced into abnormal contraction; the violent action thus instituted progresses until either nerve inhibition releases the muscles from their excessive burden or a certain degree of spasm results—a condition of flexor and extensor spasm, frequently manifested by sharp flexion of the toes. If the anterior tibial is depressed in power or tone then the posterior tibial has an extra burden put upon it, and the long flexors are called upon to assist in maintaining the normal position of the foot in weight-bearing. Under these conditions of strain the muscle irritation will be manifested by tenderness and pain in the muscles or pain referred along the tendons to their insertion, or both, and to the structures adjacent to the muscle attachments. If the derangement of muscle balance begins within the organism from pathological conditions, or is initiated by some external condition, as false poise of the body or vicious positions of the feet under strain, the result is a perversion of function. When the anterior tibial is depressed in power or tone, the posterior tibial is stimulated to greater action to compensate for the loss of power. Under continued overstimulation, this muscle is depressed and becomes relaxed, or it may develop spasm, even of a comparatively violent nature. Under this condition of spasm the stress exerted upon the os calcis by virtue of the relationship of the posterior

Fig. 1.

Fig. 2.

tibial tendon to it, this bone is tilted upward relatively, producing a subluxation at the calcaniocuboid and the astragaloscaphoid articulations, and the angle at the juncture of the tarsus and the antitarsus is increased, producing a higher arch of the foot than normal. The pain resulting from this condition is due to the irritation in the muscle, it being manifested in the muscle and referred to the insertion of its tendons; it is also due to the strain produced in ligaments which enter into the composition of the mediotarsal joint.

The deductions as to the mechanism of the condition above outlined have been drawn from clinical observations. As a further evidence of the *modus operandi* of the altered muscle balance and function more or less frequently encountered in patients suffering from pain in the tarsus, Dr. P. G. Skillern, Jr., found in the dissecting room of the University of Pennsylvania Medical School a condition of unilateral subluxation of the mediotarsal joint of apparently static origin. He was then investigating the mechanism and results of traumatic luxation[1] simultaneously with the writer's study of the static causes and conditions of subluxation of this joint. The specimen was carefully studied to determine the etiological factors and mechanics of the abnormality, and the facts obtained supported the opinion that static subluxation had developed during life. Two other specimens were found and carefully investigated. Further study by comparison with specimens, not showing results of spasm or luxation, and feet of patients was continued to ascertain whether posterior tibial contractions and mediotarsal subluxation were due to post-mortem conditions. It was fair to assume that *rigor mortis* was not responsible for this condition found in the specimens, because the posterior tibials under study were shortened, and the other muscles were not affected; also in other specimens in which there was a rigid condition all the muscles were affected alike.

The anatomical specimens, the facts gained by post-mortem study, and the clinical data were submitted to Dr. George A. Piersol, Professor of Anatomy in the University of Pennsylvania, whose opinion was that the contractions of the posterior tibial under these circumstances were not due to post-mortem changes.

Post-mortem study. Careful dissection was made of the specimens under investigation, preserving all the muscles, their tendons, and the joint ligaments. The first specimen (Fig. 1) showed a considerable degree of subluxation. The antitarsus was depressed below the normal line of the foot, it was adducted, the arch being considerably increased, and a moderate degree of varus was

[1] "Luxation of Mediotarsal (Chopart's) Joint." Ann. Surg., Phila., 1913, June, 918.

Fig. 3.

Fig. 4.

present. On the dorsum of the foot a large portion of the joint surface of the head of the astragulus could be felt under the joint capsule and its prominence could be easily seen. Under the ligaments on the dorsal and plantar aspects of the foot, the margins of the calcaneocuboid articulation showed about one-third degree of luxation. This condition was found when the foot was allowed to rest in a position in which gravity or other stress played no part in the mechanical factors. Strong force was then applied to dorsally flex the foot, and the joint surface of the astragaloid head and the luxated joint surface of the os calcis at its cudoidal articulation, changed their relative positions only in a slight degree. The calcaneoscaphoid and calcaneocuboid ligaments were contracted, it being necessary to divide the ligaments in one specimen before complete reduction could be accomplished.

Following this the tendo achillis was cut, the same flexing force applied with practically no more change in the joint surface relationship than was first observed. Again the tendons of the long flexors of the toes were cut and the same flexing force applied and the relation of the joint surfaces remained the same. The tendon of the peroneus longus was then cut and the flexing force applied, and the degree of luxation was not further reduced. Finally the ligamentous bands over the tendon of the posterior tibial below and posterior to the internal malleolus were dissected away (Fig. 2) in order to remove the tendon from its groove, to release its action and to preserve the entire muscle. When the tendon was slipped out of its groove and the flexing force applied (Figs. 3 and 4), then both the astragaloscaphoid and calcaneocuboid joint surfaces easily moved into their normal relationships. When the tendon was replaced into its groove below the internal malleolus and dorsal flexion attempted, the same relationship existed as first described (Figs. 1 and 2). Fig. 4 shows reduction of subluxation in the astragaloscaphoid joint when the posterior tibial tendon has been removed from its groove.

A radiograph was made of the specimens (Fig. 5) with the same dorsally flexing force applied, with the posterior tibial tendon in its groove below the internal mallleous, and the same condition of subluxation of the joints remains as was observed to be present in other tests. By comparison, the relationship of the joint structures in the specimen bears a striking resemblance to the same structures shown of the living foot (Fig. 6). About 50 subjects or 100 feet were observed in the dissecting room and about two per cent exhibited the conditions herein described.

Fig. 5.

Fig. 6.

Clinical manifestations. The writer has studied the conditions herein discussed in eight distinct patients, having observed it in the first patient June 28th, 1910, and has found it present in varying degrees in a fairly large percentage of cases. The symptoms are, *subjectively:* Sharp lancinating pain in the plantar region of the tarsus, located at the astragaloscaphoid, or calcanœcuboid joint, or both. It was fairly constantly associated with pain in the posterior tibial muscle, and occasionally slight pain in the anterior tibial, and frequently pain and tenderness in the long flexor muscles of the toes. Occasionally sharp, shooting pains were observed to be referred forward in the antitarsus, generally more to the inner than to the outer side. The patient experienced great fatigue after not long continued weight-bearing, the pain becoming intense and associated with progressive spasm. The pain and spasm subsided after prolonged rest, but on retiring would persist long into the night if not until morning, and it was observed that twenty-four hours or more was a period too short in which to gain relief. *Objectively:* The posterior tibial muscle was tender to pressure, its tendon was cordlike and sensitive to pressure, and at its insertion tenderness was found. Pressure over the plantar tarsal ligaments produced pain generally to a greater degree over the dorsal aspect of the mediotarsal joint. On manipulation a certain degree of rigidity of the tarsus was observed, more in the direction of dorsal than plantar flexion, and plantar flexion gave more pain in the tarsus than a force to obtain dorsal flexion would produce. An undue prominence of the head of the astragalus could be felt and only partially disappeared on dorsal flexion. Heel raising in weight-bearing also caused pain in the tarsus. Forced voluntary dorsal and plantar flexion caused pain in the tarsus and the forced flexion occasionally would bring on spasm and severe pain in the tarsus. As a rule inflammatory manifestations were not present. Occasionally moderate swelling was observed dorsally and laterally at the juncture of the ankle-joint and tarsus. As a rule, the arch

Fig. 10.

Fig. 11.

Fig. 7.

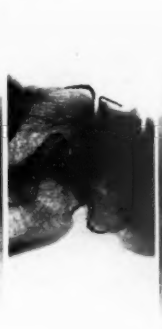


Fig. 8.

Fig. 9.

of the foot was increased and there was a moderate degree of varus. Although manipulative plantar flexion gave greater pain than dorsal flexion, severe pain was produced by attempted heel raising due apparently to enforced strain upon the posterior calf muscles.

The degree of mobility or luxation of the mediotarsal joint is by no means always commensurate with the symptoms present, any more than is the degree of flattening or pronation of the feet proportionate to the symptoms manifested. There are so many factors entering into the symptom-complex of talipes planus that it avails the physician but little who is content to "prop up the

Fig. 12.

Fig. 13.

arch" and "take chances" on the results. A foot may show a movement from the normal in the relationship of all its joints and give trifling, if any, symptoms. Consequently it is not fair to assume that a subluxation of the mediotarsal joint constitutes a pathological entity, even when symptoms of relaxation are present; but if the observations have been made accurately, and if the deductions are correct—that painful contracture of the posterior tibial muscle and painful static subluxation of the mediotarsal joint, associated with other abnormal conditions herein named have a clinical and pathological reality,— then it is fair to state that, these conditions coexisting,

Fig. 14.

Fig. 15.

produce disability, and are amenable to treatment.

Radiographic study. Radiographs made of patients suffering from mediotarsal pain showed a more or less constant relationship in the joint structures, especially in the presence of rigidity, irrespective of the position in which the foot was placed. Figs. 6, 7, 8 and 9 were made of the same subject with the feet placed in different positions, and, as illustrations show, the relationship is not materially altered. Figs. 10, 11, 12, and 13 were made from patients who had tarsalgia and were taken with the foot placed at varying degrees of extension and plantar

Fig. 16.

Fig. 17.

flexion. In these cases there is a fairly constant relationship of the joint structures. Figs. 14 and 15 were made of the writer's foot and illustrate the movement which takes place in the mediotarsal joint when there is no spasm of the muscles controlling that joint. Figs. 16 and 17 also demonstrate the slight amount of motion that may take place in an abnormally flexible foot from the position of right angles to extension with plantar flexion.

Treatment. The writer has used, with a varying degree of success, the following treatment. In severe cases prolonged rest from weight-bearing in a plaster of Paris cast, followed by exercises, massage, etc., to tone up the weakened muscles. During this treatment, methods to improve the patient's general condition were employed, after which a shoe to hold the foot in a proper position in weight-bearing was prescribed, which was designed especially to prevent tarsal torsion. In mild cases, such measures as massage, sedative local applications, adapted exercises, and the proper shoe were used, with temporary regulation of the mode of life, which was the exciting factor of the malady.

In all cases, if there exists a constitutional predisposing cause, general treatment must be employed and good hygiene should be instituted and maintained. As an operative measure, from the condition observed it seems fair to assume that a tendoplasty of the posterior tibial tendon when it is contracted, or an arthrodesis of the calcaneocuboid or astragaloscaphoid joints, or both, would be a rational procedure, provided that the correction of static errors has not proved to be efficient.

CONCLUSIONS.

1. That such a condition is of static origin, generally combined with a systemic disturbance.

2. That the condition of static subluxation of the mediotarsal joint has for its principle factor a contraction and shortening of the posterior tibial muscle, and generally is associated with a depression of tone and power of the anterior tibial.

3. That a fairly constant type of symptoms can be found.

4. That it usually exists without a frank inflammatory process present.

5. That the condition will yield to prolonged rest or palliative measures, or both.

6. That a certain derangement of relationship of structures in the foot and leg, and perversions of function, will produce a definite type of pain in the tarsus, or tarsalgia.

A DISCUSSION OF POTT'S FRACTURE WITH COMPLICATIONS; BASED ON A SERIES OF 208 CASES[1]

By KELLOGG SPEED, M. D., Chicago

As a basis for study of this fracture, I have taken the cases of fracture discharged from the Cook County hospital during the year October, 1912, to October, 1913, comprising 1,316 cases. As the histories are filed merely under the heading "fracture," it was necessary to go over this entire number of history sheets, and it was found that in this period there were 208 cases diagnosed as Pott's fracture, fracture of both bones at the ankle, fracture of either one or the other malleolus or both malleoli, but all called Pott's fracture at one point or other on the history sheet in the examining room or in the wards both before and after skiagram was made. To establish the findings in these 208 cases so grouped together by this name, equaling 15 per cent of all the fractures discharged from the institution, it was necessary, in addition, to obtain from the histories information regarding the taking of skiagrams and what knowledge of the case was obtained from the pictures. It was found that in only 24 cases no skiagram had been taken, for the most part because the patient had left the hospital before thirty-six hours' stay or had refused treatment; and in 95 per cent of the cases where skiagram is recorded as having been taken, little or no notation of the findings discovered by it are recorded and even when recorded little definite information results. For instance, two cases of Dupuytren's fracture are noted, a few of both malleoli, and many of "typical Pott's" etc., while in a very small number definite information as to exact point of fracture and bone or bones involved is given and in one glorious exception it is recorded that the astragalus is dislocated outwards somewhat.

The men making these records doubtless knew at the time exactly the type and extent of lesion in each case, but for one reviewing this work, a dry subject and perhaps a trite one at its best, it became necessary to review also these skiagrams after digging out their serial number from the depths of each history and then obtaining them from the hospital files. Covering these 208 cases of fracture I have been able to find and inspect 161 skiagrams.

The idea back of this investigation is to attempt to standardize and particularize these fractures about the ankle, to establish a habit of exactness in nomenclature, and to narrow down these common breaks to exact description such as could be conveyed in few words. Incidentally, it seems that the last word will always remain to be spoken on fractures. The more one sees and reads of them the more one realizes how much can be learned from them, and it is possible that better and more efficient treatment can be accomplished by such studies as these. If one stops to consider, it is quite difficult to define exactly what a Pott's fracture is. I have asked many surgeons this question recently and get many different answers.

The definition given by Pott in his book in 1769 is that of a fracture of the fibula three or four inches above the external malleolus with a tearing of the internal lateral ligament.

On looking over these skiagrams I have been struck by the relatively few "typical Pott's" and the lowness, toward the tip of the malleolus, of the site of fracture in a majority of the cases, and have classified them as follows, noting carefully in each case where the external malleolus was fractured whether the skiagram also showed a separation from the bony surface of the internal malleolus or by position of the astragalus that the internal lateral ligament had been ruptured. Such cases treated by a Dupuytren splint with the foot in marked adduction, later being placed in a cast in this position, should give good results; and I have tried to note the result where the X-ray photographs were also taken after the foot had been set, paying par-

[1] Read before the Chicago Surgical Society, April, 1914. (See discussion, p. 120.)

Fig. 1 A. Fig. 1 B.
Fig. 2 A. Fig. 2 B.

Figs. 1 A and 1 B, examples of tibiofibular separation, comminution of the lower end of the fibula with displacement of the astragalus outward, but not in the antero-posterior axis.

Figs. 2 A and 2 B, fibular fracture with some backward displacement of foot due to epiphyseal separation of tibia. The ligaments undoubtedly hold in the rear and there is no lipping fracture.

ticular attention to the position of the astragalus in regard to the weight-bearing axis and lipping fractures with callus thrown out that would interfere with ankle motion.

ENUMERATION OF SKIAGRAPHIC STUDY OF THE ANKLE FRACTURES

External malleolus alone	60
External malleolus with fracture internal lateral ligament as evidenced in skiagram	31
Internal malleolus alone	10
Both malleoli	47
Appreciable separation of interosseous ligaments	10
Both bones fractured above epiphysis	12
Fracture external malleolus and epiphyseal separation	1
Lipping fracture	16
Marked displacement of astragalus:	
Inward	5
Backward	6
Outward	25
Result after setting—using tibio-astragalar axis as basis:	
Good	38
Bad	27

Analysis of these figures demonstrates that fracture of both malleoli is about two-thirds as common as fracture of the external malleolus alone, that it is five times as frequent as fracture of the internal malleolus alone, and about once and one-half as frequent as fracture of the external malleolus plus fracture of the internal lateral ligament. If external malleolar fractures alone and with internal ligament fracture are considered, they are twice as frequent as bimalleolar fracture. These figures also show that "lipping fracture" occurs in at least 10 per cent of these ankle fractures and should be watched for in every case, and that good results, as demonstrated by the skiagrams, are not obtained in more than four-sevenths of the cases treated. Colvin, of Saint Paul, analyzing 60 cases of ankle fracture, reports about one-fourth as consisting of fracture external malleolus, one-fifteenth internal malleolus alone, and nearly one-half as bimalleolar. He notes only one case out of sixty as consisting of fracture of the fibula and rupture of the internal lateral ligament, calling this the only true Pott's fracture in the series (fibula three inches above joint and rupture internal lateral ligament).

Considerable has been written lately concerning a mathematical calculation of the prognosis of ankle fractures from skiagraphic study, taking as criteria the lines or axes of weight-bearing force and the correct relation of joint surfaces. If these are good,—that is, if the joint surface of the lower tibial end and the astragalus bear a correct relation to each other and a line drawn through the weight-bearing axis of the leg from the anterior superior iliac spine straight down through the patella passes through the middle of the astragalus body,—the prognosis for a useful weight-bearing function of the foot and ankle is excellent. It is said that one can disregard the position of fragments if these points are satisfactorily established, but I believe that stand is not well taken; for the powerful supporting lateral ligaments of the ankle, attached as they are to the lower tips of the malleoli above, must be replaced in a position of relative balance and allowed to heal in that position before useful painless function can be hoped for and this can only be accomplished by replacing these malleoli in normal

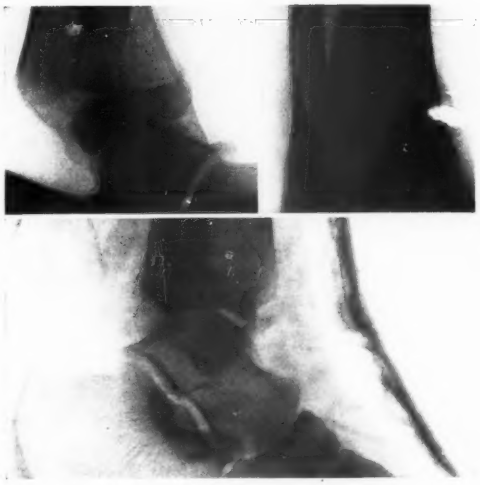


Fig. 3 A. Fig. 3 B.
Fig. 4.

Figs. 3 A and 3 B, epiphyseal separation lower end of tibia with fracture of fibula and marked backward displacement of foot and astragalus. Note that anteroposterior picture shows the astragalus in its mortise and gives no information in regard to the fracture.

Fig. 4. Fracture reduced and in plaster. No open operation.

position and reëstablishing the conformity of the tibio-astragaloid articulation. Of great importance also are the lipping fractures involving the tibia with posterior or anterior displacements of the astragalus.

An anteroposterior skiagram may not show these, or a picture taken after reduction may show a good result as far as the restoration of the mortise is concerned, which if further analyzed by a lateral view, would show a displaced lipped fragment of the tibia and give a poor prognosis for the full use of the ankle. The astragalus head rests firmly mortised between the two malleoli, which lock it in and hold the articulating surface directly under the lower joint surface of the tibia, which is the bone of weight-bearing. As Skinner has advised, the anteroposterior skiagram should give us information in regard to the condition of this mortise and the exposure should be made with the center of the focus about an inch above the center of a line drawn between the two malleoli, the foot being held at right angles to the leg.

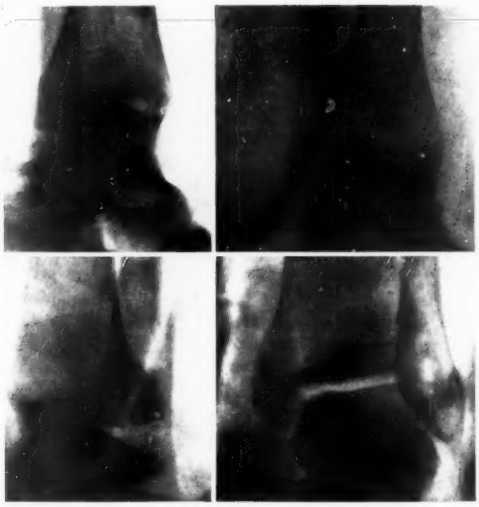


Fig. 5. Fig. 6.
Fig. 7 A. Fig. 7 B.

Fig. 5. Fracture of fibula and tearing off of tibial epiphysis beginning at anterior border with foot displaced backwards.

Fig. 6. Fracture of fibula releasing hold of posterior ligaments. Foot evidently forced forwards by trauma, causing a lipping fracture of anterior margin of tibia. Note how this drops down in front of joint and might be replaced and held by keeping foot in hyperflexion for a few days. Callus forming about this might easily interfere with full movement of ankle.

Figs. 7 A and 7 B. Oblique fracture of lower end of fibula allowing ligamentous support to give way, astragalus shoved on back and lipping fracture of posterior border of tibia. Mathematical calculation taken from an anteroposterior view is worthless.

If the lower end of the fibula has been split or twisted alone by the trauma, our indication for treatment is to hold the astragalus well up against the internal malleolus and then hope to drag the cracked or broken external malleolus over to its proper position by forced inversion, depending on such fibers of the external lateral ligament as are still intact. Should both malleoli be broken off, our method of treatment becomes a more difficult task. Here forced inversion alone is not sufficient, as, in bimalleolar fracture, we can always look for displacement of the astragalus either out or in, forward or back, according to the direction of the causative trauma, so the real indication consists in returning the astragalus to the weight-bearing axis and then fixing

the malleoli in some such way that they will hold the astragalus in that position. This can sometimes be done by manipulation and a subsequent plaster swathe or cast, but many cases require subcutaneous nailing to hold both sides in position. Where bimalleolar fracture is complicated by rupture of the interosseous ligament and a separation of the lower ends of the two bones, with a possible forcing upwards of the astragalus between them, nothing short of open operation with the two bones pressed together, the astragalus returned to its proper articular position and the two malleoli nailed on and the tibia nailed to the fibula, will preserve good function and prevent the wide painful ankle. After such operation or happy mechanical reduction in bimalleolar fracture the foot should not be put up in adduction, but should rest at a right angle and be allowed a long immobilization to permit the malleoli to unite firmly with a minimum of callus, and this callus to mature; also to allow the torn ligaments to reunite, a process which takes longer than bony union, and to establish a normal circulation of rest in the ankle. When the splint is removed, very light massage and passive motion may be indulged in, but not to a point of pain at any time, and no weight-bearing on the foot should be allowed for two or three weeks. Then the weight may be gradually applied. If painful, this is ample evidence that the callus is not yet matured and a further wait is necessary.

At the inception of weight-bearing, if the external malleolus has been the greatest sufferer in the fracture, the patient should be cautioned to hold the foot straight forward or with toes turned slightly in and the inner side of the heel and sole should be raised slightly. This holds the foot in better weight-bearing axis and helps avoid a yielding of the young callus in the fibula and the weakened internal lateral ligament.

Fig. 8 A.

Fig. 8 B.

Fig. 9 A.

Fig. 9 B.

Figs. 8 A and 8 B. Fracture just above joint. Note posterior deformity in lateral view of which no hint is given in the front view and a case where the mathematical calculation as derived from the front view would lead one into serious error. Figs. 9 A and 9 B. Repair by operation and insertion of a right-angled steel plate of fracture shown in Fig. 8. Tibia brought into alignment and slot cut into upper and lower fragments into which the right angled plate is inserted and then screws driven in to hold position. This makes a very firm support in both planes. Clips in skin.

Besides the mathematical calculation of position of the astragalus, one must take into consideration fracture of the extreme edge or lip of the articular surface of the tibia. By this I mean a splitting off of a wedge-like piece, usually of the compact bone alone, the line of fracture starting at the joint and extending upwards along the shaft for a varying distance of one-half to two inches or more. These are much like the sprain fractures at the wrist and are caused by a similar mechanism; i. e., wedging force upwards by the astragalus, which force may be in a direct line upwards or at a varying angle and directed toward the anterior, interior, posterior or outer side of the lower end of the tibia de-

pending on the position of the foot at the time of the trauma and the additional pulling tearing out stress of the capsular ligament, tibiofibular posterior ligaments, on the bone surface. These I have frequently observed in the last three years and have applied to them the term "lipping fractures." If these fragments are not replaced, although the astragalus may be situated quite perfectly anatomically and the fracture of either malleolus be but a mere split, a great interference in function results. This is explained by the fact that callus is thrown out under this misplaced shell of bone shoved down in front of the ankle-joint at some quarter of its circumference which later by its presence and possible adherence to capsular ligament or the astragalus causes marked interference with full flexion or extension of the ankle-joint, and provokes much pain after use of the joint by mechanically impinging against the astragalus. Such ankles may show perfect alignment of malleoli and astragalus and yet be extremely painful after mild use. These lipping fragments should be searched for carefully, both clinically and in the skiagram, and replaced by hyperextension or hyperflexion at the time the fracture is set. If they cannot be reduced by manipulation, I believe they should be nailed on in correct position through a small skin opening after which, if malleolar fracture is present, the foot can be put up in the proper position to meet the demands of the case. I find this condition mentioned by Robert Jones [1] and his whole word on the subject can be profitably quoted: "I have frequently seen a wedge of bone knocked off the anterior and outer part of the lower end of the tibia. This may occur by itself or as a complication of a Pott's fracture. The detached fragment is liable to slip down a little and block dorsiflexion and, therefore, interfere with walking. The treatment in the first instance is to get the foot into extreme dorsiflexion, thus pushing the fragment out of the way. If the foot is fixed in this position for a few days the condition will not recur.

Fig. 10 A.

Fig. 10 B.

Figs. 10 A and 10 B. A bursting forward of the anterior edge of the tibia. Lipping fracture. The anteroposterior view gives no information of the serious condition.

Fig. 11.

Fig. 11. Complete fracture of internal malleolus alone. Astragalus pushed outwards a little.

In old standing cases, the patient comes with a history of an injury to the ankle or of a fracture in that region, and complains of pain over the front of the ankle-joint. On inspection, the foot seems rather fuller than its fellow in this region. The X-ray photograph shows some irregularity of outline chiefly due to irritation periostitis. The treatment is to operate, removing the offending portion of bone and making sure that the foot can be completely dorsiflexed. If the patient declines operation, then the only thing to be done is to raise the heel of the boot so that the front of the astragalus does not impinge on the front of the tibia when walking."

This study shows that displacement of the

[1] Am. J. Orthop. Surg., 1913, xi, 314.

astragalus, when its changed position is marked enough to call a displacement, is five times as frequent outwards as it is inwards or backwards, taking into consideration all types of fractures whether of one malleolus or both. Where both malleoli are broken, putting the foot in adduction alone would not be sufficient even if the astragalus were displaced outwards five times as frequently as any other direction; but, as expressed before, the malleoli must be returned to normal position, and then if necessary to retain the replaced dislocation of the foot, it should be put up in adduction. If the malleoli are nailed on, the foot can be held in quite marked adduction without fear of disturbing the replaced malleoli and every opportunity given to the important internal lateral ligament for a strong healing.

Fig. 12 A.

Fig. 12 B.

Figs. 12 A and 12 B. Oblique fracture of lower end of fibula allowing ligamentous support to fail and a resulting posterior lipping fracture. Good position is shown by the anteroposterior picture.

Fig. 13.

Fig. 13. Marked lipping fracture with extreme displacement backwards. This form of fracture and displacement, if unrecognized, gives rise to much impairment of function.

I believe that close attention should be paid consequently to the exact findings of each ankle fracture, especially in a hospital where a skiagram may be had for the asking in addition to clever clinical diagnosis, and each case should be treated conscientiously and intelligently according to the findings. Among a laboring class nothing so interferes with wage-earning as weakened leg support and the whole train of life that follows the ability to get about on two good feet is very different from that which follows the permanent and partial disability of a bad ankle. These fractures do have some permanency treated by the very best methods devised to date and each man so afflicted should be given the best attention to shorten his disability and should not be allowed to use the ankle until callus is hard enough and ligaments are firmly enough healed to bear his weight, and not cause a further interference with his wage-earning power within a few weeks after he has returned to his occupation. The ankle fractures may mean in every case except those of the slightest crack a disability of three months, and in severe cases nine to fifteen months is not unusual.

The ankle fractures with posterior displacement of the foot are by far the most important and I wish to call attention to their frequency, their mechanism, treatment and prognosis as they are frequently overlooked entirely and lead to premanent disability.

In 1900, Bondet concluded that the posterior displacement of the foot in malleolar fractures is produced, first by dislocation of

the tibiotarsal mortise, second by combined action of weight and muscular contraction, third often by the existence of a posterior tibial fragment — the presence of which is not revealed except by a skiagram.

In 6,000 radiographs from the clinic of the Charité at Berlin, Pels did not find a single case of pure tibio-astragalar luxation,—i. e., without fracture,—as in every case either the anterior or posterior border of the tibia or both were fractured. In 1907, Grashey in 1500 radiograms found 4 of the posterior tibial margin and a year later Meissner, in Bruns' clinic, stated he had seen 19 cases.

1 isolated fracture of the posterior tibial margin.
8 with fracture of both malleoli.
1 with fracture of the internal malleolus.
5 with fracture of the fibula.
4 with epiphyseal separation.

Later, Chaput noted 42 cases in 136 skiagrams of malleolar fractures and says that from a clinical point of view the small fragments interfered with extension and are the origin of hyperostoses, while large fragments cause a posterior subluxation of the astragalus. Their reduction is difficult and they often complicate ankyloses in bad position with considerable hyperostoses.

Fig. 14.

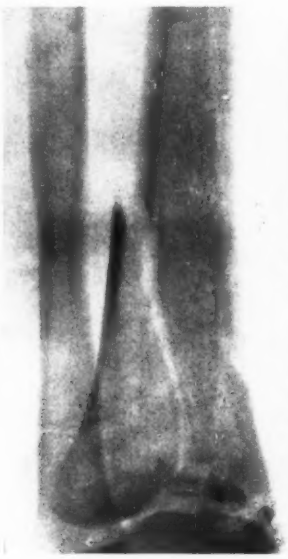


Fig. 15 A.

Fig. 15 B.

Fig. 14. An old bimalleolar fracture with eversion deformity, foot not able to bear weight. The problem lies in cutting through and removing part of fibula at site of fracture, removing the bone mass in the interosseous space, replacing the astragalus under the end of the tibia so that weight may be borne. The internal malleolus must be cut off and replaced in proper position on inner side of tibia. After replacement all fixed by nails. Tenotomy of the tendo achillis often necessary or cutting off a portion of the lower end of the tibia to swing the astragalus into position.

Figs. 15 A and 15 B. An unusually large posterior lipping fracture accompanied by fracture of the internal malleolus. The external lateral ligament seems to hold, the loss of support being on the inner side in this case.

Destot, in 1911, gives as signs the pointing forward of the tibia and the difficulty of reducing and maintaining the reduction. He believes that the marked enlargement of the internal malleolus and the rare possibility of feeling the tibial fragment in the retromalleolar depression are diagnostic, and suggests that they be treated by: first, osteotomy of the fibula; second, cutting off the posterior tibial surface by an osteotome introduced along its posterior wall; third, open reduction.

In the same year Quénu reported 15 cases as follows:

1 posterior margin of the tibia alone.

2 accompanied by malleolar fractures.

3 accompanied by fractures of the upper end of the fibula.

Stimson considers the lipping break of the tibia as complication of Pott's fracture and in 1908 had never seen a recent case — all being old. He raised the fragment in two cases, corrected the displacement and obtained a useful foot. In one he removed the articular surface of the tibia, leveled off the astragalus, getting a bony union with a good result.

Fig. 16 A.

Fig. 16 B.

Fig. 17 A.

Fig. 17 B.

Figs. 16 A and 16 B. Bimalleolar fracture, astragalus pushed out and also posteriorally. Note internal malleolus pulled clear down under joint surface.

Figs. 17 A and 17 B. Repair of fracture shown in Fig. 16 by nailing. Note astragalus in proper weight-bearing axis in reference to tibia, also pushed forward in proper position and malleoli nailed on where they belong. Clips in skin.

From the prognostic standpoint the lipping fracture is a lesion of the greatest importance and in old cases the advisability of recourse to operation is imperative. Formerly no recent cases of this type of fracture were reported nor treated with this point in mind — they are now coming into the literature.

Mechanism. Most all are caused by slipping or a fall with the foot in hyperextension and often abducted and a tearing out of the articular border of the tibia by the posterior articular and tibiofibular ligament accompanied by a crushing force upward and backward transmitted by the astragalus. The theory is further advanced that after fracture of the fibula a continuation of the line of force now not meeting with resistance comes against the lip of the posterior articular surface and chips it off. This is very plausible but does not explain cases of isolated fracture of the posterior or anterior lip. Fracture of the posterior lip alone has been considered very rare. Quénu finds but three, to which he adds a fourth, and Plagemann mentions finding but two cases in eighteen years of practice.

Examination generally shows painful extension or flexion and an anteroposterior skiagram may show no trace of fracture but the lateral view shows the lines in the tibia.

Clinically it is quite impossible to obtain a point of extreme local tenderness over these isolated lipping fractures or to obtain crepitation, but in a so-called Pott's fracture with marked posterior displacement of the foot and the absence of injury or deformity in the tarsal bones one should suspect these breaks. Without a skiagram and where the lipping fracture exists with little displacement of its fragment one may rely partly on the presence of an extended ecchymosis along the posterior surface of the ankle or a point of extreme tenderness to pressure under the tendo achillis in the depression back of the malleoli. The amount of displacement of the foot seems to give no key as to the possibility of lipping

fractures: the amount of separation of the tibiofibular joint or the laceration of this ligament may give indication, but the surest means of detection is careful study of the dried skiagram.

Posterior displacement of the foot does not occur in the ordinary Pott's and where it does we must consider clinically that something more has happened in the ankle area than mere fracture of the fibula. If the fibula is broken three or four inches above its lower end, if the internal lateral ligament is ruptured at the same time, or if the tip of the internal malleolus is pulled off, we will not get a posterior displacement of the foot. If all the soft parts around both malleoli are severed, if both lateral ligaments are cut, there will be no posterior displacement of the foot.

If, then, we find such posterior foot displacement, what must we consider? When the astragalus is displaced backwards it can only occur when the external malleolus is freed fully from the external side of the lower end of the tibia. Should both malleoli be broken and the tibiofibular junction and ligament remain intact, no posterior displacement presents, although we might find all degrees of internal or external displacement. To obtain the freedom of the external malleolus, then, we must have either a fracture very low down on the external malleolus, which allows the lower fragment, with its attached strong ligaments, by its obliquity to slip back, or a diastasis of the tibiofibular junction with laceration of its ligament, or possibly a fracture of the fibula high up with its line extending down into the tibiotarsal joint. There seems to be little doubt that fracture of the posterior lip of the tibia of varying degree is due to a further action of the force of separation of the tibiofibular ligament which, being stronger than the bony surface into which it is inserted, pulls out the corner of the tibia and preserves its own fibers intact but allows the separation and displacement of the astragalus. To this is added, of course, lesions of the two lateral ligaments or the malleoli. The foot, in so being displaced posteriorly, drags with it in practically every case its malleoli. Hence we conclude that fracture of the posterior tibial lip alone is not sufficient to allow posterior displacement of the foot, even when accompanied by malleolar damage, unless the external malleolus is freed as mentioned.

Treatment for all ankle fractures should be prompt reduction under anæsthesia, the possible exceptions being those cases greatly traumatized and swollen beyond manipulation. If lipping fragments or sharply pointed malleolar fragments threaten to necrotize through the skin they should be reduced at once. Where manipulation fails, I believe subcutaneous extra-articular nailing is the proper step. Old fractures may be reduced after three or four weeks by manipulation or by open operation consisting of osteotomy of the fibula, operation for removal or replacement of marginal pieces, perhaps by nailing them on, or, in severe cases, operation on the articular surface of the tibia accompanied by fibular osteotomy and a clearing out of the callus in the tibiofibular ligamentous area. Other cases may be best handled by a leveling operation on the head of the astragalus with replacement in the weight-bearing axis or a complete astragalectomy.

SUMMARY

1. Ankle fractures are relatively numerous and have much influence on the wage-earning power of laboring people.

2. Pott's fracture as classically understood is very rare.

3. Each ankle fracture should be treated in accordance with the most searching diagnosis, aided if possible by skiagrams, and not by routine method.

4. Too much faith should not be given to anteroposterior skiagrams through the ankle mortise. Lateral views should be made to show the correct position of the astragalus in the anteroposterior axis and to reveal lipping fractures.

5. More emphasis should be laid on the treatment of fracture of the external malleolus with or without ligamentous damage on the inner side of the ankle by overcorrection in extreme inversion on a splint or in a cast.

6. Special attention should be paid to cases with posterior or anterior displacement of the foot, as these indicate lipping fractures of the tibia or complete separation of the external

malleolus with loss of support of either anterior or posterior tibiofibular ligaments. Operation should be considered in these cases, particularly to obtain the best result.

7. Operative measures, of simple replacement, nailing, or other procedures, give perfect anatomical results in selected cases.

8. Use of the foot should not be permitted until pain is not caused.

REFERENCES

1. SKINNER, E. H. The Mathematical Calculation of Prognosis in Fractures at the Ankle and Wrist. 1913, Tr. Internat. Cong. Med., Lond.
2. COLVIN, A. R. Fracture of the Lower Ends of the Tibia and Fibula. Surg., Gynec. & Obst., 1914, xviii, 99.
3. SKINNER, E. H. The Mathematical Calculation of Prognosis in Fractures at the Ankle and Wrist. Surg., Gynec. & Obst., 1914, xviii, 238.
4. JONES, ROBERT. An Orthopedic View of the Treatment of Fractures. Am. J. Orthop. Surg., 1913, xi, 314.
5. BONDET. Lyon, 1900.
6. PELS. Berl. klin. Wchnschr., 1905, No. 5.
7. GRASHEY. Fortschr. a. d. Geb. d. Röntgenstr., 1907.
8. MEISSNER. Beitr. z. klin. Chir., 1908, lxi.
9. CHAPUT. 1899, Monograph.
10. DESTOT. Traumatisms du Pied et Rayons X.
11. QUÉNU. Fractures Marginales Postérieures, Rev. de Chir., 1912.

PLACENTA PRÆVIA AND ITS TREATMENT[1]

BY PROFESSOR DOCTOR W. NAGEL, BERLIN, GERMANY
Honorary Fellow of the American Gynecological Society and the Obstetrical Society in Edinburgh

IT once seemed that with the introduction of version by the Braxton-Hicks method the last word had been said in the treatment of placenta prævia. With this method the Berlin school, as represented by Gusserow and Schroeder achieved such remarkably favorable results as compared with the older method—viz., tamponade of the vagina until complete dilatation of the os, then version and extraction, or in cases of impaction of the fœtal head, forceps—that it soon became the dominating one in Germany. Hofmeier[2] in Schroeder's Clinic had but one maternal death out of 37 cases, Behm[3] in Gusserow's Clinic had 35 cases and no death. Later, Zweifel published 62, Wegelins 16 and Hauck 18 cases, all three also without any maternal mortality. Döderlein[1] gives the average maternal mortality at 7.8 per cent, and the infant mortality at 73.7 per cent. This latter figure is unfavorable as compared with the average infant mortality of 54.12 per cent under the older method.

It is unjust to attribute the high infant mortality to the treatment used, as in most cases of placenta prævia we have to deal with immature children whose vitality has been lowered by disturbances of the fœtal circulation during labor, as a result of the unavoidable separation of the placenta. Even though these facts were apparent, the high infant mortality gave rise to a number of methods, partly based on the older methods, partly innovations. These methods I shall briefly describe.

1. *Abdominal cæsarean section.* With an early diagnosis, good aseptic conditions, and a living child, the result must be a favorable one, and published reports show this to be so.

In the above-mentioned paper by Döderlein, we find a large number of cases: Krönig (35), Sellheim (8), Parker Davis (7), Recaseus (4) with no maternal mortality and an infant mortality of 0 (Sellheim) to 42.86 per cent. The average amounted to 8.9 per cent maternal and 33 per cent infant mortality. Cæsarean section will, however, never be practicable in routine cases and Döderlein has even curtailed its use in hospital and clinical practice and gives as contra-indications: (1) infection from the patient herself; (2) fever, (3) examinations made by physicians and midwives before admission to the hospital, (4) tamponade, (5) extensive hæmorrhages, (6) marginal insertion of placenta (because in this case the patient can be confined in a simple manner), (7) in cases where fœtus is

[2] M. Hofmeier, Ztschr. f. Geburtsh. u. Gynäk., viii.
Behm, Ztschr. f. Geburtsh. u. Gynäk., ix.
Döderlein, Internat. Med. Cong., Lond., 1913.

[1] An extract of this paper was read in the discussion on placenta prævia in Section VIII of the Seventeenth International Congress of Medicine, London, 1913.

either dead or not viable (amounting to about 50 per cent in hospital cases of placenta prævia). After eliminating these cases, very few remain for cæsarean section.

In desperate cases cæsarean section may be the only available method. Webster [1] reports a case in a girl 14 years of age, with copious hæmorrhages, infantile vagina and narrow pelvis, in which he operated successfully for the mother.

The modification of the classical cæsarean section.

2. *The extraperitoneal cæsarean section* is recommended by Sellheim in aseptic cases with living child and no great hæmorrhage. But even in such cases extraperitoneal cæsarean section cannot be said to offer good prospects inasmuch as the incision is made through the maternal portion of placenta with its enormous sinuses. Hofmeier contends that the vascularity at this point is no greater than that of any other part of the uterus. That this view does not agree with the anatomical facts, I have shown at the International Congress at London in 1913. Hofmeier's view has been obtained through examination of poorly injected specimens.

3. *Vaginal cæsarean section* is Dührssen's modification of "accouchement forcé," as practiced by French obstetricians of the seventeenth century, by Guillemeau and Mauricean in cases of hæmorrhage during pregnancy. Both the accouchement forcé and vaginal cæsarean section, have the disadvantage that the incision is made through the placental site by reason of which large maternal vessels are opened. As the incision is made in the interest of the child, extraction must be rapid, and in consequence and favored by the spongy nature of the tissues of the lower uterine segment, the incision is enlarged by tearing, so that we have enormous hæmorrhages to contend with after the extraction of the child. The placenta must be rapidly removed so that the incision and the tears can be quickly sutured. The suturing is unusually difficult, the cut and torn edges cannot be held by volsellas as the latter tear out when downward traction is made on them, the extensive bleeding meanwhile making orientation impossible. Furthermore, the hurried removal of the placenta tends to cause atony of the uterus, which encourages severe bleeding, much to the damage of the already greatly depleted patient.

The results, therefore, were bad and former advocates of the method such as Bumm and Krönig, now warn against it.

It is significant that even Dührssen, the one who originated the method, has modified it in cases of placenta prævia and extends the cervical incisions only so far that the metreurynter can be introduced into the cavity of the uterus. The uterus also must not be pulled down, Dührssen says, but should simply be fixed to prevent separation of placenta.

In remarkable contrast to the bad experiences of other operators are the results given by Döderlein's Clinic, 34 vaginal cæsarean sections with one death.[2] In Döderlein's compilation at the International Congress, London, we find 88 cases with 9 maternal deaths, 3 of the children were stillborn and 44 not viable. According to Döderlein, the total mortality of the mothers was 11.3 per cent, of children 21,7 per cent.

4. *Metreurysis.* Originally a rubber bag (Barnes, Keiller) was introduced into the cervical canal below the amniotic cavity, and then filled. Its object was to check bleeding and induce pains. The effect as far as pains are concerned is very uncertain and the introduction of the bag between amniotic cavity and uterine wall certainly causes a further detachment of the placenta, as is evidenced by the bleeding which follows the removal of the bag. Dührssen modified the procedure by introducing the bag into the amniotic cavity after the membranes had been ruptured or the placenta (in case of central insertion) perforated. The intra-amniotic metreurysis will check the bleeding as surely as the bringing down of the foot, but it will cause circular compression of placenta. The most practical of the bags for this purpose is that of Champetier de Ribes, as it is made of non-elastic material and can be filled to "its fullest capacity." Traction can be made on the tube by means

[1] J. Clarence Webster Textbook of Obstetrics, 1903.

[2] Seitz Arch. f. Gynäk., Bd. 99.

of a cord, passed over the edge of the bed, and to which has been attached a small weight, such as an empty bottle.

It is necessary to perform version immediately after expulsion of the bag; i. e., if the presenting part has not already entered the cervix, which latter is generally not the case as the bag has a tendency to displace the fœtus. If the largest sized bag (with a diameter of 10 cm. at its base) has been used, the cervix is now dilated to such an extent that extraction can be made immediately. Herein lies the advantage of intra-amnial metreurysis, and one can expect, therefore, a lower mortality among the children. In fact, Dührssen had very good results in his first 6 cases — 5 living children. Later authors were not so fortunate: Leopold reports 11 cases with 5 living and 6 dead children. Zweifel could see no advantage in this method as far as either control of bleeding or the rapid dilatation of the os was concerned. According to the compilation of Döderlein, given conditionally, the mortality of mothers is 6.5 per cent, of children 45.4 per cent. It is clear that the prospects of the child are dependent to a large extent upon the area of compression made upon the placenta by the bag. If a large part of the placental circulation is disturbed, the child is in jeopardy without any chance of hastening its delivery, and the advantages gained by introduction of the bag are lost. Added to this, experience has shown that the bag should only be allowed to remain a short time (four to six hours according to Leopold), as the injuries to the cervical tissue increase the danger of septic infection.

In spite of this, metreurysis in view of the lower infant mortality and nearly equal mother mortality, will continue to have its advocates, but will not supplant combined version, as the bringing down of the foot is not a difficult procedure and does not take a longer time than the introduction of a bag.

5. *Vaginal tamponade.* Before the introduction of Braxton-Hicks version, vaginal tamponade was in Germany the prevailing method. As soon as bleeding began, the vagina was packed with tampons of cotton or gauze, or instead of this, Braun's colpeurynter was introduced and filled to its fullest extent. The object of the tamponade was to check bleeding and also to induce labor pains. The tamponade was continued until the os was dilated to such an extent that version and extraction were possible. If the hæmorrhage had in the meantime ceased, by reason of the descent of the head, and with the mother and child in good condition, things were left to nature, or extraction made by forceps. It often took a long time before pains commenced and it was necessary to frequently renew the tampons.

As a result, the patient continued to bleed and was often enough infected, as this method was used in the pre-antiseptic era. In the absence of reliable statistics, it is sufficient to say that the morbidity and mortality of mothers were very high during this period.

With our present-day method it is possible to prevent infection to a certain extent, but not entirely, as reports from various authors will show. Winckel had a maternal mortality of 5.2 per cent. In cases of placenta prævia where the tampon was employed, fever followed, according to Freund in 60 per cent, Winter 80 per cent, Sellheim 60 per cent, Friggesi 23.5 per cent, during the puerperium.

Vaginal tamponade, in the form of kolpeurysis, by which the danger of infection is lessened, has again come in favor and is recommended by Zweifel, Hammerschlag and Tauffer in cases of hæmorrhage during pregnancy and at the beginning of labor. I consider the tamponade with iodoform gauze or kolpeurynter as applicable in cases of hæmorrhage during pregnancy as a temporary measure and in the first stage of labor (except in cases of placenta prævia centralis) if there be a cephalic presentation that is allowed to proceed normally. As soon as the os is sufficiently dilated the membranes must be ruptured.

6. *Braxton-Hicks method.* Many well-known obstetricians demand that all cases of placenta prævia should be transferred to hospitals and treated preferably by cæsarean section. Desirable as it may be, the demand that all cases be thus treated is impracticable, as but a small percentage of physicians and patients have a hospital at their disposal. As far as cæsarean section is concerned, the

brilliant results of some operators are only apparently so. With the restrictions placed by Döderlein upon this operation (see above), any of the other methods would show equally good results. The practitioner must have at his command a method that can be employed at the home of the patient, and the best, that of Braxton-Hicks, will meet this requirement in most cases. In support of my opinion, I call attention to fifty consecutive cases, which I treated when obstetrician to the policlinic department of the Royal Charité at Berlin. I have never published these cases, as the attention of obstetricians had meanwhile turned to other things. But at the present time, with the Braxton-Hicks method again in the foreground and with the publication of statistics from other obstetrical clinics, my cases demand a certain amount of interest, not only on account of their number and that they were all treated along fixed lines, but from the fact that the cases were all treated (and brought to a close) in the homes of the poorer population of Berlin — and represent the work of one operator, myself.

Two deaths from acute anæmia, due to long continued previous hæmorrhages, occurred during the beginning of my career as assistant. After insisting upon being called to each and every case of bleeding during pregnancy, I was enabled to make an early diagnosis of placenta prævia, and in consequence conditions changed. In the next 44 successive cases there were no deaths from hæmorrhage. The results in my private practice have been equally good, but I wish to confine myself to policlinic cases entirely, as I intend to show that the prognosis with the Braxton-Hicks method even in most unfavorable surroundings is as good, as far as the mother is concerned, as cæsarean section under the most auspicious conditions.

My cases will show that in spite of primitive conditions asepsis was always carried through, as none of my cases died of sepsis. It is a pity that there is a tendency manifesting itself to place asepsis after technique, and, therefore, it seemed necessary to disclose that success in the first place is dependent upon *asepsis*. Above all I consider the advice, that in "urgent" cases one should disregard disinfection entirely and go right on with the operation, as condemnable.

My experience has been that even in "urgent" cases there is *always* time for disinfection; and again, of what benefit is even the most skillful operation to the patient if a fatal sepsis follows? Nowadays we would make use of rubber gloves. My cases date back to a time when gloves were not known, but the results show that the hands can be made germ-free, particularly if contact with infectious material is avoided.

I give a review of my cases in the following table and should like to point out some details.

Among the fifty mothers, four were primiparæ and 46 multiparæ. Twenty-six times the labor set in at full term and 24 times prematurely. Twice the placenta prævia was of the marginal form, twenty times it was central and twenty-eight times lateral. Forty-six times the head-presentation, nine times the transverse position, four times the foot- and once the breech-presentation prevailed. I have performed the combined (bipolar) version in thirty-eight cases (once twins), four times the internal version. In the five cases of pelvic presentation I pulled down the foot. In three cases of vertex presentation it was sufficient to rupture the membranes, after which the head descended deeply into the pelvis.

After I had brought down the foot, labor was mostly left to nature. Only in 3 cases of internal and 7 cases of bipolar version the fœtus was extracted when the external os was fully dilated. I found, before I began the treatment, a rising temperature and a frequent pulse in four cases. In spite of that the puerperium was normal in those cases.

The *third stage* completed 44 times a normal course, and the placenta was after its spontaneous separation easily expressed through Credé's method. In 8 of these 44 cases a more or less pronounced atony took place before or after the expulsion of the placenta, which was successful treated by gentle massaging. The removal of the placenta by intra-uterine manipulations was necessary in 6 cases on account of profuse hæmorrhage. In the 48 surviving cases the puerperium took 40 times a normal course; 8 times occurred in the first

days of the puerperium a rise of temperature up to 40° C., partly complicated with foul-smelling discharge. In those cases the uterine cavity was always douched thoroughly with a one-half per cent solution of lysoform and all patients recovered.

Sixteen of the children were born alive while 35 of them were still-born (two of them being twins). In 10 cases the fœtus died during labor; 23 of the 35 still-born were immature.

Concerning the technique, I performed bipolar version as early as possible, when only one or two fingers could be admitted through the os, and brought down a foot. I placed a loop around same and left the case to nature.

As long as the liquor amnii has not escaped and the fœtus is movable the operation is by no means difficult.

When the placenta covered the os completely, I burrowed the fingers right through it into the amniotic cavity. The perforation of the villi and chorionic membrane is not difficult, but the perforation of the amnion sometimes proves so, which can be avoided by pressing the presenting part with the abdominal hand against the pelvic brim, while at the same time the vaginal fingers rub gently the membrane upon the presenting part until it tears. I grasp the first obtainable foot, no matter if it is the anterior or posterior one, and bring it down into the vagina chiefly by means of the abdominal hand; namely, in the beginning of the first stage will the abdominal wall and the uterus through anæsthesia relax to such extent that the abdominal hand can push the foot, so to speak, through the os, whereupon it can be seized between the thumb and index of the vaginal hand. How far the foot can be pulled down into the vagina depends upon the dilatation of the os. It would, for instance, be a mistake to try to pull the breech immediately into the pelvic brim without considering the size of the os. Otherwise severe laceration of the cervix and hæmorrhage would occur, which would be blamed upon the method. By partially dilated os, the leg must not be pulled down further than to above the knee, which will be sufficient to check bleeding. Should any hæmorrhage occur, when the os has become more dilated, the foot may be drawn slowly until plugging again is complete; after this the expelling of the fœtus is once more left to natural forces. An extraction is only then justified when the os is fully dilated and the child still alive.

No. 1, Journal No. 934, February 26, 1888; Name, D; Age 39; XI para (abortions included); presentation of fœtus, II. Vertex, placenta prævia lateral, dext.; labor, last menstruation: middle of August, 1887. Periodical bleeding during last two months. Profuse bleeding for five hours. Very anæmic. Temp. 38.2. Pulse 120. Prolapse of weak pulsating cord. Os almost fully dilated. Bleeding stopped after version is completed. Slow extraction of fœtus. Placenta bimanually removed; operation, internal version and extraction; child, male, dead, immature (seventh month); puerperium, normal.

No. 2, Journal No. 941, February 28, 1888; Name Sch; Age 35; XIII para (abortions included); presentation of fœtus, vertex, placenta prævia totalis; labor, last menstruation: June, 1887. Hæmorrhage for five days. Profuse bleeding for five hours. Very anæmic, fainting. Os dilated to the size of one-half dollar. Hydramnion. Two fingers through the placenta. Child dead. After version bleeding stopped. Two hours later fœtus expelled. Placenta spontaneously in two pieces without hæmorrhage; operation, combined version; child, male, dead, mature; puerperium, normal.

No. 3, Journal No. 951, March 12, 1888; Name, J; Age ?; V para (abortions included); presentation of fœtus, II. Vertex. Placenta prævia lateral sinistra; labor, came to me with history of hæmorrhage for three weeks. Vagina plugged for the last eight days. For five hours strong pains with profuse hæmorrhage; extremely anæmic. Prolapse of weak pulsating cord. Os size of a dollar. After version no bleeding, two hours later fœtus expelled. Placenta born without bleeding; operation, combined version; child, male, dead; puerperium, patient died three hours later from exsanguination.

No. 4, Journal No. 82, May 3, 1888; Name, D; Age 24; VII para (abortions included); presentation of fœtus, I. Transverse position. Placenta prævia lateral, sinistra; labor, profuse hæmorrhage for three hours. Membranes ruptured five hours. Prolapse of pulseless cord and right arm. Os size of dollar. After version no bleeding; pains strong, fœtus expelled shortly after; delivery of head. Placenta without bleeding; operation, combined version; child, female, dead; puerperium, normal.

No. 5, Journal No. 95, May 7, 1888; Name, K; Age ?; II para (abortions included); presentation of fœtus, I. Transverse position. Placenta prævia central; labor, last menstruation: beginning of September, 1887. Slight bleeding for few days. On May 7th strong pains set in with profuse hæmorrhage. Os admitted two fingers. After version

no bleeding. Three hours later fœtus extracted and expressed by fully dilated os. Placenta without bleeding; operation, combined version, extraction; child, male, dead, immature; puerperium, normal.

No. 6, Journal No. 154, May 28, 1888; Name, P; Age 39; VII para; presentation of fœtus, II. Foot presentation. Placenta prævia lateral, dextr.; labor, last menstruation: middle of October, 1887. Severe bleeding for twelve hours. Temp. 38.5. Pulse 90. Os size of one-half dollar. Left foot pulled down until bleeding stopped. Six hours later os fully dilated. Fœtal sounds still to be heard; therefore, extraction. Placenta without bleeding, slight atony p.p.; operation, pulled down a foot. Extraction; child, male, dead, immature; puerperium, normal.

No. 7, Journal No. 200, June 15, 1888; name, J; Age 33; VII para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia lateral. Sinister; labor, last menstruation: November 16, 1887. Periodical bleedings for four weeks. Pains and hæmorrhage for twelve hours. Os size of quarter. Bleeding stopped after version. Fœtus spontaneously expelled soon after; operation, combined version; child, male, living, length 42 cm. Circumference of head, 32 cm. (died three hours later); puerperium, normal.

No. 8, Journal No. 273, July 14, 1888; Name, M; Age, 18; I para (abortions included); presentation of fœtus, I. Vortex, placenta prævia, later, sinistra; labor, last menstruation: beginning of December, 1887. Profuse bleeding for two days, very anæmic. Strong hæmorrhage and collapse during version. Fœtus expelled two hours later. Placenta bimanually removed. Packing of uterus and vagina. Bleeding checked; operation, combined version; child, male, dead, immature; puerperium, patient died two hours later from exsanguination.

No. 9; Journal No. 288, July 19, 1888; Name B; Age 30; VII para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia, centralis; labor, last menstruation: beginning of November, 1887. The morning of July 19 suddenly profuse bleeding, os admits one finger. Hydramnion: bleeding stopped after version. Fœtus expelled four hours later. Operation, combined version; child, female, dead, mature; puerperium, normal.

No. 10, Journal No. 316, July 28, 1888; Name W; Age 25; III para (abortions included); presentation of fœtus, II. Foot presentation, placenta prævia margin, sinister; labor came to me with temp. 38. Pulse 104. Profuse bleeding when os fully dilated. After labor slight atony; operation, extraction; child, female, living, mature; puerperium, normal.

No. 11; Journal No. 320, July 28, 1888; Name L; Age 30; II para (abortions included); presentation of fœtus, II. Vertex, placenta prævia later, sinister; labor, last menstruation: end of November, 1887. Profuse periodical bleeding for six hours; pains slight Os admits two fingers. Bleeding stopped after version. Fœtus expelled twelve hours later; operation, combined version; child, male, dead, mature; puerperium, normal.

No. 12; Journal No. 326, July 30, 1888; Name B; Age 30; XI para (abortions included); presentation of fœtus, II. Vertex, placenta prævia, central; labor, last menstruation: December 4, 1887. Profuse hæmorrhage. Os almost fully dilated, covered with placenta. Went through placenta, performed version and extraction. Placenta bimanually removed; operation, internal version, extraction; child, male, dead, immature; puerperium, temp., first day, 36.5; second day, 38; third day, 40.1. Pulse 140. (Uterine cavity washed out.) Evening temp. 39. Fourth day, 38; fifth day, 36.9. Temp. remained normal. Recovery.

No. 13; Journal No. 419, September 1, 1888; Name, R; Age 39; IV para; presentation of fœtus, II. Vertex. Placenta prævia centralis; labor, last menstruation: middle December 1887, severe bleeding for four hours. Os size of dollar. No bleeding after version. Fœtus expelled seven hours later. Arms and head artificially delivered. Placenta without bleeding; operation, combined version; child, female, living, mature; puerperium, normal.

No. 14; Journal No. 466, September 25, 1888; Name, K; Age 31; VII para (abortions included); presentation of fœtus, II. Vertex. Placenta prævia lateral, sinister; labor, last menstruation: beginning of January. Two hours ago very profuse bleeding, so that she fainted. Very anæmic. Os size of a dollar. Bleeding stopped after version; fœtus expelled few hours later; operation, combined version; child, female, dead, immature; puerperium, normal.

No. 15; Journal No. 378, October 14, 1889; Name, G; Age 20; I para (abortions included); presentation of fœtus, transverse position. Placenta prævia centralis; labor, last menstruation: beginning of March. Profuse bleeding for some hours. After version no bleeding. Fœtus expelled three hours later. Placenta spontaneous one-half hour later without bleeding; operation, combined version; child, female, living, immature (died the following day); puerperium, normal.

No. 16; Journal No. 385, October 29, 1889; Name, Sch; Age 27; III para (abortions included); presentation of I. Vertex. Placenta prævia later, sinister; labor, last menstruation: January. For three hours severe bleeding. Anæmic. Os size of half dollar. After version no bleeding; fœtus expelled one and one-half hours later. Placenta spontaneous without bleeding; operation, combined version; child, female, dead, mature; puerperium, normal.

No. 17; Journal No. 400; October 29, 1889; Name, Sch; Age 38; X para (abortions included); presentation of fœtus, vertex. Placenta prævia later, sinister; labor, last menstruation: end of February. Severe bleeding. Twins. After extraction of children atonic bleeding. Placenta bimanually removed. Uterus hereafter firmly contracted and no bleeding; operation, combined version and extraction; children, females, both dead, length 30 cm.; puerperium, normal.

No. 18; Journal No. 415, November 5, 1889; Name W; Age 37; XI para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia, marg. sinister.; labor, last menstruation: December, 1888. Profuse bleeding for two hours. Liquor amnii escaped. Os lets the hand through. Child dead. Bleeding stopped after version. Placenta spontaneous expelled one-half hour later without bleeding. Piece of membranes removed; operation, internal version and slow extraction; child, female, dead; puerperium, normal.

No. 19; Journal No. 433; November 15, 1889; Name, Sp; Age 29; III para (abortions included); presentation of fœtus, II. Incomplete foot presentation. Placenta prævia, lateralis; labor, last menstruation: end of March. Moderate bleeding; prolapse of posterior left leg. Os twice the size of a dollar. Left foot pulled down, which rotated in front under strong pains. No bleeding after breech entered pelvis. Third state without bleeding; operation, pulled down a foot; child, female, dead, length 43 cm.; puerperium, normal.

No. 20; Journal No. 453, November 25, 1889; Name H; Age 41; XI para (abortions included); presentation of fœtus, II. Vertex. Placenta prævia centralis; labor, last menstruation: April 21. Bleeding for last 20–24 hours. Hæmorrhage with every pain. Fœtus dead. Os size of dollar, covered all over with placenta. Went through the placenta. Fœtus slowly extracted. Placenta expelled shortly after without bleeding; operation, combined version, extraction; child, male, dead, immature; puerperium, normal.

No. 21; Journal No. 460, November 29, 1889; Name H; Age 25; IV para (abortions included); presentation of fœtus, I. Transverse presentation. Placenta prævia lateral dextr.; labor, last menstruation: beginning of March, bleeding for five hours. Liquor amnii escaped. Os size of quarter. Bleeding stopped after version. Fœtus expelled two hours later. Placenta delivered without bleeding; operation, combined version; child, female, living; puerperium, normal.

No. 22; Journal No. 465, November 30, 1889; Name L; Age 22; II para (abortions included); presentation of fœtus, II. Vertex. Placenta-prævia lateral, sinister.; labor, last menstruation: March 13. Bleeding for fourteen days; very profuse for two hours. Very anæmic. Os admitted two fingers. After version no bleeding. Fœtus expelled four hours later. Collapse after child is born. Placenta expressed; operation, combined version; child, female, living, length 47 cm.; puerperium, normal.

No. 23; Journal No. 521, December 27, 1889; Name D; Age 25; I para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia lateral. sinister.; labor, last menstruation: May 1st. Bleeding with pains for eight hours. Os size of quarter. No bleeding after version. Fœtus expelled three hours later. Placenta delivered without bleeding; operation, combined version; child, male, dead, length 46 cm.; puerperium, normal.

No. 24; Journal No. 531, January 1, 1890; Name H; Age 22; II para (abortions included); presentation of fœtus, II. Vertex. Placenta prævia lateral, sinister.; labor; last menstruation: May 4th. Severe hæmorrhage for two hours. Temp. 39.5. Pulse 100. Fœtal sound 180. Os size of dollar. Bleeding stopped after version. Fœtus expelled four hours later. Placenta without bleeding; operation, combined version; child, female, dead, immature; puerperium, normal.

No. 25, Journal No. 575, January 20, 1890; Name Sch; Age 36; XIII para (abortions included); presentation of fœtus, II. Transverse position. Placenta prævia total; labor, last menstruation: end of June. Bleeding for several hours. Anæmic. Os size of dollar. After version no bleeding. Fœtus expelled two and one-half hours later. Placenta without bleeding; operation, combined version; child, female, dead, immature; puerperium, normal.

No. 26; Journal No. 611, February 6, 1890; Name F; Age 28; VI para (abortions included); presentation of fœtus, II. Transverse position. Placenta prævia lateral. sinister.; labor, last menstruation: not known. Profuse bleeding for four hours. Os admitted one finger. After version no bleeding. Fœtus expelled three hours later. Placenta without bleeding; operation, combined version; child, female, dead, immature (eighth month); puerperium, normal.

No. 27; Journal No. 637, February 12, 1890; Name B; Age 38; IX para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia later, sinister.; labor, last menstruation: December 6, 1889. Profuse bleeding for six hours. Os size of dollar. Strong pains. Head engaged in pelvic brim. Bleeding stopped after membranes ruptured. Fœtus expelled three hours later. Placenta without bleeding. Patient collapsed soon after but rallied; operation, ruptured membranes; child, female, living; puerperium, normal.

No. 28; Journal No. 721, March 14, 1890; Name M; Age 39; XI para (abortions included); presentation of fœtus, II. Vertex. Placenta prævia centralis; labor, last menstruation: August 15, 1889. Severe bleeding for some hours. Os size of quarter. After version no bleeding. Fœtus expelled two hours later. Placenta without bleeding; operation, combined version; child, male, dead, length 42 cm.; puerperium, normal.

No. 29; Journal No. 2, April 1, 1890; Name R; Age 43; XI para (abortions included); presentation of fœtus, II. Vertex. Placenta prævia centralis; last menstruation: July 23, 1889. Severe bleeding for hours. Os size of quarter. No fœtal sounds heard. Bleeding stopped after version. Fœtus expelled one and one-half hours later. Placenta without bleeding; operation, combined version; child, female, dead, immature; puerperium, normal.

No. 30; Journal No. 21, April 10, 1890; Name Sch; Age 37; VIII para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia lateralis; labor, last menstruation: beginning of August, 1889.

Severe bleeding for two hours. Os admitted two fingers. Bleeding stopped after version. Fœtal sounds good. Fœtus expelled two hours later. Placenta with slight bleeding; operation, combined version; child, male, living, mature; puerperium, normal.

No. 31; Journal No. 59, April 23, 1890; Name Sch; Age 25; VI para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia centralis; labor, last menstruation: August 12, 89. Slight bleeding during last three days. Severe bleeding for two hours. Anæmic. Fœtus dead. Os size of dollar. No bleeding after version. Strong pains. Fœtus expelled one-half hour later. Placenta with slight bleeding; operation, combined version; child, female, dead, mature; puerperium, from the third to the sixth day foul smelling discharge and rise of temperature. Intra-uterine douching. Recovery.

No. 32; Journal No. 73, April 27, 1890; Name K; Age 32; II para (abortions included); presentation of fœtus, vertex. Placenta prævia lateral, sinister.; labor, last menstruation: end of September, 1889. Severe bleeding for last two hours. Liquor amnii escaped ten hours ago. Os admitted two fingers. Bleeding stopped after version. Fœtus expelled under strong pains three hours later. In the third stage severe bleeding, due to atony. Placenta expelled; operation, combined version; child, female, dead, immature; puerperium, normal.

No. 33; Journal No. 72, April 29, 1890; Name T; Age 34; VIII para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia later. dextr.; labor, last menstruation: July 24, 1889. Slight periodical bleeding during last four weeks. Pains began last night with severe hæmorrhage. Os admitted two fingers. No bleeding after version. Strong pains. Fœtus expelled four hours later, asphyctic but rallied. Profuse hæmorrhage in third stage. Placenta bimanually removed; operation, combined version; child, male, living, mature; puerperium, normal.

No. 34; Journal No. 95, May 6, 1890; Name B; Age 31; III para (abortions included); presentation of fœtus, vertex. Placenta prævia centralis; labor, last menstruation: end of August, 89. Periodical bleeding during last four weeks. Continual slight bleeding for a week. Os size of dollar. No bleeding after version. Fœtus expelled under strong pains; one-half hour later; head delivered. Placenta without bleeding; operation, combined version; child, female, living, length 45 cm.; circumference of head 32 cm.; puerperium, normal.

No. 35; Journal No. 245, July 4, 1890; Name B; Age 35; IX para (abortions included); presentation of fœtus, II. Vertex. Placenta prævia centralis; labor, last menstruation: October, 1889. Bleeding in intervals during last week. Slight pains. Profuse bleeding after internal examination. Os size of half dollar. No bleeding after version. Fœtus expelled three hours later. Slight atony in the third stage; operation, combined version; child, female, living; puerperium, normal.

No. 36; Journal No. 247, July 6, 1890; Name Tr.; Age 30; IV para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia centralis; labor, last menstruation: September 31, 1889. Bleeding for first time three weeks ago. Periodically severe bleeding for some hours and during examination. Os size of half dollar. Abundant liquor amnii. Bleeding stopped after version. During expulsion of fœtus repeated hæmorrhage. Extraction of fœtus by almost fully dilated os. Atony during third stage; operation, combined version; child, male, dead, length 50 cm.; puerperium, patient very anæmic. On the fourth day rise of temperature and foul-smelling discharge. Transportation to clinic. Recovery.

No. 37; Journal No. 268, July 16, 1890; Name L; Age 30; IV para (abortions included); presentation of fœtus, II. Vertex. Placenta prævia lateral. dextr.; labor, last menstruation: middle of December. Bleeding at intervals for some days, especially during pains, that day I was called. Os size of dollar. No bleeding after version. Placenta expelled immediately after fœtus; operation, combined version; child, female, dead, immature; puerperium, normal.

No. 38; Journal No. 297, July 28, 1890; Name K; Age 41; IV para (abortions included); presentation of fœtus, II. Vertex. Placenta prævia centralis; labor, last menstruation: not known. Hæmorrhage for twelve hours. Os size of dollar. No bleeding after version. Fœtus expelled an hour later. Placenta without bleeding one-half hour after expulsion of fœtus; operation, combined version; child, male, dead, mature, length 53 cm.; puerperium, normal.

No. 39; Journal No. 395, September 9, 1890; Name K; Age ?; XI para; presentation of fœtus, II. Vertex. Placenta prævia lateral, sinister.; labor, last menstruation: beginning of January. Bleeding since yesterday; bleeding for some hours so severe that midwife ruptured the membranes. Very anæmic. Os size of dollar. Bleeding stopped after version. Fœtus expelled one hour later. Placenta bimanually removed. Atony; operation, combined version; child, male, living, length 54 cm.; circumference of head 36 cm.; puerperium, normal.

No. 40; Journal No. 414, September 16, 1890; Name M; Age 31; VI para (abortions included); presentation of fœtus, II. Vertex. Placenta prævia centralis; labor, last menstruation: middle of December, 1889. During early months of pregnancy several times bleeding and threatening abortion. Bleeding at intervals for six hours; at my arrival profuse hæmorrhage, os size of dollar. No bleeding after version. No fœtal sounds to be heard. Fœtus expelled two hours later. Placenta three-quarters of an hour after expulsion of fœtus with slight hæmorrhage; operation, combined version: child, female, dead, length 50 cm.; circ. of head 34 cm.; puerperium, slight atony during first days, recovery.

No. 41; Journal No. 537, November 18, 1891; Name G; Age 30; I para (abortions included); presentation of fœtus, I. Foot presentation. Placenta prævia lateral. sinister.; labor, last menstruation:

beginning of May, 1891. Liquor amnii escaped three days ago, since then slight bleeding at intervals, strong bleeding at arrival. Temperature rising for last twelve hours, now temperature 38.4 Cels. Pulse 140. Os size of a quarter. Fœtus expelled four hours later. Placenta without bleeding; operation, pulled down a foot; child, male, dead, immature; puerperium, shortly after labor, temperature 38.1. Pulse 116. Recovery.

No. 42; Journal No. 550, November 23, 1891; Name B; Age 36; VIII para (abortions included); presentation of fœtus, II. Vertex. Placenta prævia centralis; labor, last menstruation: middle of March. Severe bleeding for several hours. Very anæmic. Os twice the size of a dollar. Membranes not ruptured. Internal version through the placenta. Child dead, and expelled one-half hour later. No bleeding after version. Placenta without bleeding; operation, internal version; child, female, mature; puerperium, on the fifth day, temperature 38.2. Pulse 122, then normal.

No. 43; Journal No. 598, December 12, 1891; Name Sch; Age ?; VI para (abortions included); presentation of fœtus, II. breech presentation. Placenta prævia centralis; labor, last menstruation: beginning of March; during last weeks periodical bleeding. Profuse hæmorrhage four hours ago. Os size of a quarter. During expulsion of fœtus bleeding several times, fœtus born six hours later. Slight atony after expulsion of placenta; operation, pulled down a foot; child, female, dead, length 51 cm.; puerperium normal.

No. 44; Journal No. 666, January 6, 1892; Name Sch; Age 27; IV para (abortions included); presentation of fœtus, I. Transverse position. Placenta prævia lateralis; labor, last menstruation: uncertain. Periodical bleeding for several days with slight pains. Severe bleeding for few hours. Os size of dollar. No bleeding after version. Fœtus expelled two hours later. Placenta without bleeding; operation, combined version; child, male, dead, length 45 cm., immature; puerperium, normal.

No. 45; Journal No. 684; Name A; Age 34; VI para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia lateral; labor, last menstruation: uncertain. Severe bleeding for some hours. Anæmic. Os size of dollar. No bleeding after version, fœtus expelled until appearance of breech in pelvic outlet few hours later. As fœtal sounds to be heard, manual delivery of arms and head. Slight atony in third stage; operation, combined version. Delivered arms and head; child, female, living, length 45 cm.; puerperium, normal.

No. 46; Journal No. 732; Name F; Age 27; III para (abortions included); presentation of fœtus, I. Transverse position. Placenta prævia total; labor, last menstruation: August, 1891. Slight periodical bleeding during last six days. Os size of half dollar. After version no bleeding, fœtus expelled four hours later. Placenta without bleeding; operation, combined version; child, male, living, immature; puerperium, on the third day, temperature 38.7. Pulse 120; fourth day, temperature 37.3. Pulse 100. Recovery.

No. 47; Journal No. 755, February 19, 1892; Name Sch; Age 35; IV para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia later. dextr.; labor, last menstruation: June, 1891. Severe bleeding at intervals during last hours. Anæmic. Os size of one-half dollar. No bleeding after version. Fœtus expelled six hours later. Placenta without bleeding; operation, combined version; child, female, immature (seventh month); puerperium, normal.

No. 48; Journal No. 758, February 20, 1892; Name Pf; Age 23; II para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia lateral; labor, last menstruation: beginning of June, 1891. Periodical hæmorrhages during last five hours, at first severe. Strong pains. Os almost fully dilated. Head in pelvic inlet. After rupture of membranes head descended and bleeding stopped. Fœtus expelled shortly after. Placenta without bleeding; operation, membranes; child, male, living, length 45 cm.; circ. of head 31 cm.; puerperium, normal.

No. 49; Journal No. 769 February 24, 1892; Name K; Age 29; V para (abortions included); presentation of fœtus, I. Transverse position. Placenta prævia centralis; labor, last menstruation: July, 1891. Bleeding February 18th and 23d. Slight pains, slight hæmorrhage. Os size of one-half dollar, and covered with placenta. No bleeding after version, no fœtal sounds. Fœtus expelled one-half hour later. After expression of placenta slight atony; operation, combined version; child, male, dead, length 43 cm.; puerperium, normal.

No. 50; Journal No. 790, February 29, 1892; Name M; Age 34; VIII para (abortions included); presentation of fœtus, I. Vertex. Placenta prævia lateral, sinister.; labor, last menstruation: May, 1891. Two days ago hæmorrhage with slight pains, for eight hours hæmorrhage at intervals. Temperature 37 C. Pulse 100. Slight anæmia. Strong pains for one-half hour. Os size of dollar. Head in pelvic inlet. No bleeding after rupture of membranes and head descended quickly. Fœtus expelled one hour later. Placenta without bleeding; operation, ruptured membranes; child, female, living; puerperium, on the third and seventh days temperature 40.3 C. Foul-smelling lochia. Intra-uterine douching. Recovery.

DEPARTMENT OF TECHNIQUE

AN OPERATIVE TECHNIQUE FOR RADICAL EXTIRPATION OF VESICAL NEOPLASMS

By J. BENTLEY SQUIER, M. D., New York City
Professor of Genito-Urinary Surgery, New York Post-Graduate Medical School and Hospital
AND
CHAS. GORDON HEYD, M. D., New York City
Lecturer in Surgery, New York Post-Graduate Medical School and Hospital

THE success of any operation upon the bladder for malignant disease will be judged solely by the end-result, and the final criterion must be the percentage of cases which survive the primary operative mortality, and remain free from recurrence after the arbitrary time limit.

Statistics demonstrate that resection of the bladder for malignant disease has been so frequently succeeded by recurrence that the usual approach has been inadequate for complete extirpation, or at least in preventing implantation recurrence.

With these ideas in mind it has been our aim to elaborate a technique for the exposure of the bladder and its contained neoplasm that would allow of an extensive resection of the bladder wall adjacent to the growth as well as an orderly plastic repair of the ureters if these should be found invaded.

The growth is removed *en masse* with a wide encircling margin of healthy tissue, and since it is a matter of record that a functionating bladder has been regenerated where only the trigone has remained after an extensive excision, it is apparent that it is only necessary to conserve the three natural orifices of the bladder, the ureteral orifices and the internal meatus. Considering this anatomic trinity, the technique about to be outlined exposes the bladder in its entirety, and renders it possible to free the posterior and fundal attachments as far as the trigone, without an unusual degree of hæmorrhage or traumatism. *Seratim*, the steps are as follows:

First step. Skin incision. From one inch above the umbilicus on the left side, downwards to two inches above the symphysis in median line.

The sheath of the rectus is divided along the whole length of the skin incision and the peritoneal cavity opened. The patient is then placed in the extreme Trendelenburg position and the intestines gently deposited in the upper portion of the abdominal cavity. After this the pelvic cavity is thoroughly walled off by gauze rolls.

Second step. Exposure of the prevesical space. Lengthen the abdominal incision downwards through skin and fascia and divide the pryamidalis muscle at the symphysis, exposing the prevesical space.

Third step. Exposure of the hypogastrics (Fig. 1). The peritoneum and urachus are grasped with a Barrett's intestinal forceps at the lower angle of the peritoneal incision. Upon traction being made upwards, the obliterated hypogastric arteries are brought prominently into view extending laterally as two diverging cords.

Fourth step. Exposure of the vas deferens (Fig. 2). The left obliterated hypogastric artery is grasped with a forceps and traction made upwards and to the right. By blunt dissection between the obliterated hypogastric artery and lateral wall of the pelvis, the left vas deferens is recognized and brought into view as it courses along the pelvic wall to the inner side of the obliterated hypogastric artery.

Fifth step. Exposure of the ureters (Fig. 3). By gentle traction the left vas deferens is made taut and by means of blunt dissection downwards along its course the pelvic ureter is uncovered as it bends inward above the fascia of the pelvic floor to enter the bladder. The ureter at this point is crossed on its inner side by the vas deferens. A similar exposure is made on the opposite side and the right ureter exposed.

Sixth step. Final separation of peritoneum from the bladder (Fig. 4). The urachus is divided close to the bladder and from the two points of lateral dissection the peritoneum is stripped off the fundal surface of the bladder. The denudation extends deep into the rectovesical space and the

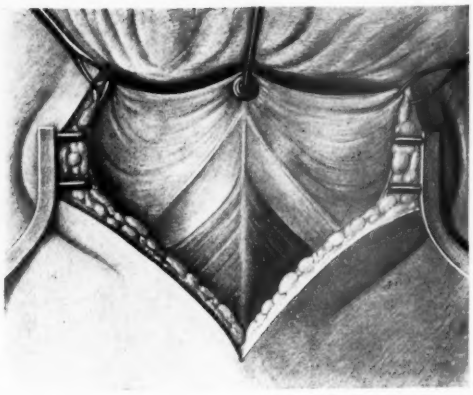


Fig. 1. Exposure of prevesical space. Urachus and diverging obliterated hypogastric arteries held taut by intestinal forceps.

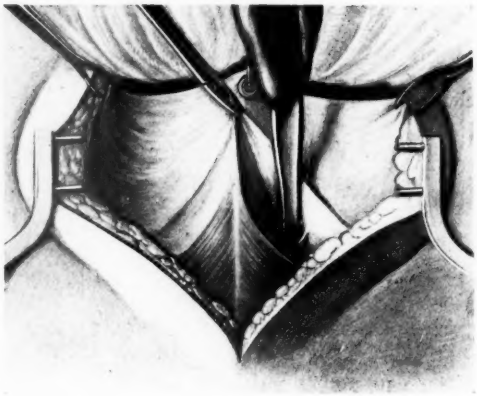


Fig. 2. Exposure of the left vas deferens by blunt dissection along the course of left obliterated hypogastric artery.

peritoneal cul-de-sac of Douglas is pushed upwards and backwards. At this point traction on the bladder downwards towards the symphysis exposes the superior poles of the seminal vesicles. The result of the completed denudation is that the whole fundus of the bladder and the upper portion of the posterior surface of the trigone is exposed; the ureters are constantly in sight and the anterior or pubovesical attachments of the bladder have been left undisturbed. No hæmorrhage of any moment has been encountered and the venous ooze has been easily controlled by hot wet pads.

Seventh step. Protection of the peritoneal cavity. The denuded lamella of the peritoneum is carefully attached to the upper end of the abdominal incision so that all subsequent procedures are extraperitoneal.

Eighth step. Exposure of bladder neoplasm (Figs. 5, 6, and 7). The bladder is grasped high up on the posterior surface and an incision is made in the longitudinal direction, about one inch in length. Through this opening an inspection of the bladder is made and the typography of the tumor determined. The incision is extended in any direction that may be necessary for proper operative exposure. Since, in the majority of instances, the tumor will be found to occupy either the summit, side, or trigone of the bladder,

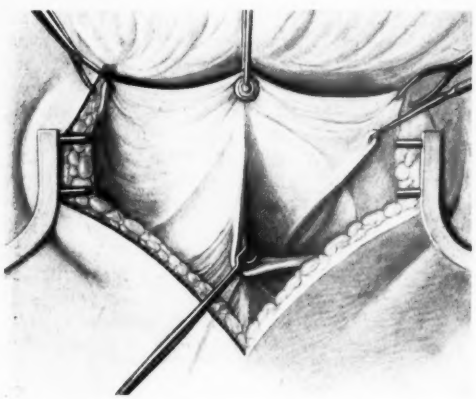


Fig. 3. Exposure of left ureter by blunt dissection along the course of left vas deferens.

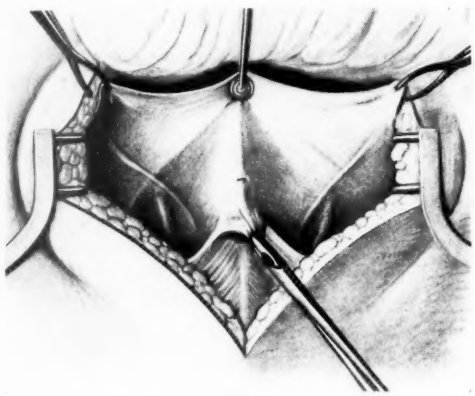


Fig. 4. The final separation of peritoneum from the bladder exposing both ureters, vasa deferentia, and upper pole of trigone.

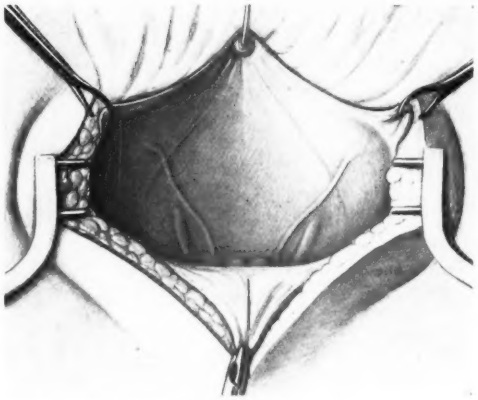


Fig. 5. The bladder pulled downwards towards the symphysis and the primary incision in the bladder for inspection of the neoplasm.

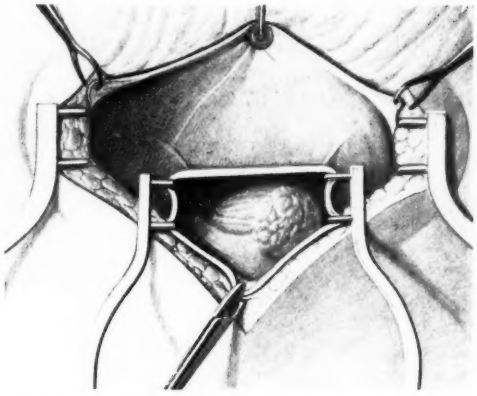


Fig. 6. The bladder incision enlarged downward towards trigone for more thorough inspection.

an incision downward in the posterior median line, which splits the organ in half, will be the usual incision of election.

Ninth step. Extirpation of neoplasm (Fig. 8). The neoplasm is excised *en masse*, together with a wide margin of healthy, uninvaded tissue comprising the entire thickness of the bladder wall. The exposure of the ureter which has already been made now becomes of prime importance. If the ureter is affected it is divided between ligatures above the growth and the distal portion is removed with the tumor. The proximal portion is allowed to remain undisturbed until partial closure of the bladder defect is accomplished.

Tenth step. Closure of bladder defect with implantation of ureter (Fig. 9). The hiatus of the bladder wall after incision of the tumor is partially repaired as illustrated in Fig. 9, the method of closure being similar to the Connell intestinal suture with No. 2 chromic catgut. A stab-wound is made through the bladder wall at a point approximating the normal ureteral opening and the proximal portion of the divided ureter drawn through this opening by a thin dressing forceps.

Eleventh step. Anchoring the ureter to the bladder mucosa (Fig. 10). The ureter is brought through the stab-wound and anchored to the bladder wall. About one-half to three-fourths of an inch of the ureter is allowed to protrude into the bladder. Two flaps are made by bisection of the ureteral stump and the flaps turned back and

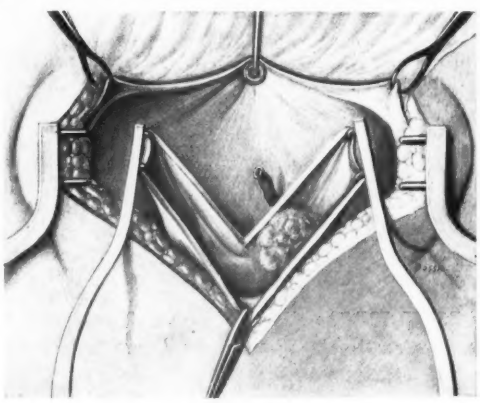


Fig. 7. Bisection of posterior bladder wall previous to extirpation of neoplasm.

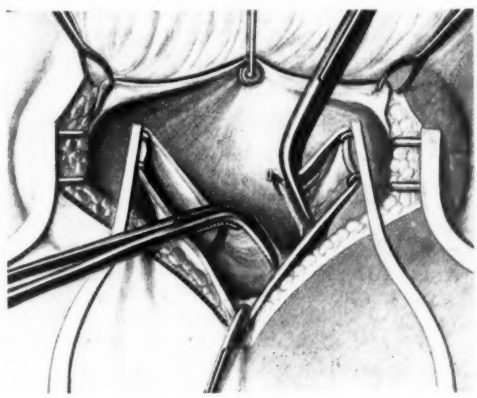


Fig. 8. The neoplasm and affected ureter excised *en masse* with wide encircling margin of healthy tissue; hæmostasis assured by right angle tissue forceps; temporary ligature around proximal ureter.

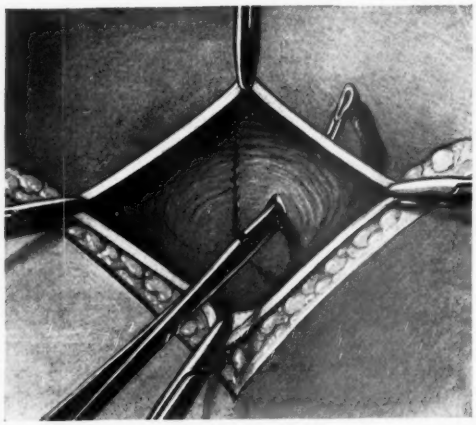


Fig. 9. Partial closure of defect in bladder wall and stab-wound for implantation of ureter. Dressing forceps grasping ureter.

anchored *in situ*. The remaining defect in the bladder is now sutured as above and drainage of the bladder instituted by means of a stab, button-hole incision, anterior to the line of incision and at a point which will correspond to the highest point of the bladder when the operation is completed. Through this aperture a No. 26 F. soft rubber catheter is drawn and sutured *in situ*. A drainage tube inserted in this manner insures against leakage along the tube into the prevesical space, a point previously emphasized by the senior author (Squier, Fig. 11).

Twelfth step. Closure of abdominal wound. The final step is the reposition of the peritoneum over the vesical suture line and an accurate closure of the peritoneum. If the peritoneum is invaded by the growth, the involved portion is resected with the growth and the peritoneal hiatus closed after the usual fashion, particular care being taken to prevent a peritoneal suture line being superimposed upon a bladder suture line. A cigarette drain is inserted into each lateral space leading down to ureter and the abdomen closed with figure of eight silkworm sutures. In addition, a self-retention catheter is inserted (Fig. 12).

Among the advantages of this method of technique may be mentioned:

1. By primary denudation of the peritoneum a free access to the posterior surface of the bladder and trigone is obtained.

2. The removal of the tumor is *a removal en masse*. If necessary, the lymphatic glands along the lateral walls of the pelvis and iliac vessels may be removed.

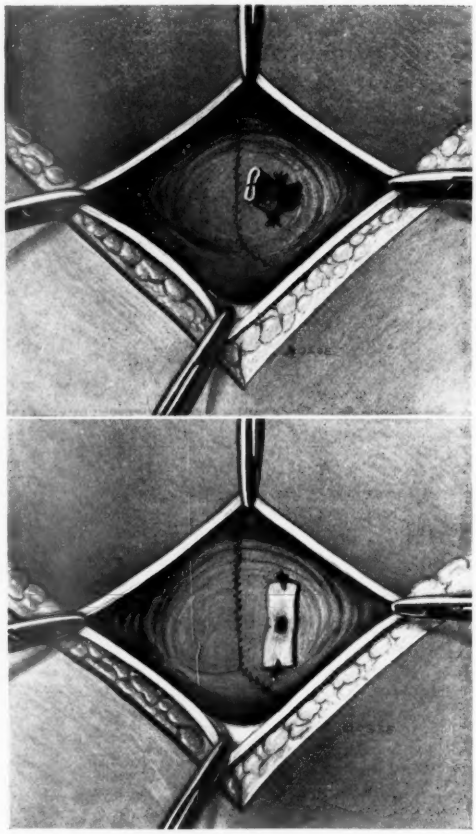


Fig. 10. Implantation of divided ureter after partial closure of bladder defect.

3. The counterstab button-hole drainage at the highest point of the bladder is a decided improvement in technique.

4. The non-interference with the pubovesical attachment is a distinct advantage and makes for rapidity of convalescence.

5. The reposition of the peritoneum minimizes the leakage and insures primary union.

6. The ureters are constantly in sight and their exposure allows a wide latitude of operative procedures.

Fifteen patients[1] suffering from various stages of vesical carcinoma have been operated by this

[1] Fifteen patients with vesical carcinoma have been operated by this method since June, 1912. In the last three the technique was carried out without entering the peritoneal cavity, thereby making the operation entirely extraperitoneal. In addition approximately the same technique has been utilized for removing calculi at the lower end of the ureter and for an extensive plastic resection for diverticulum of the bladder.

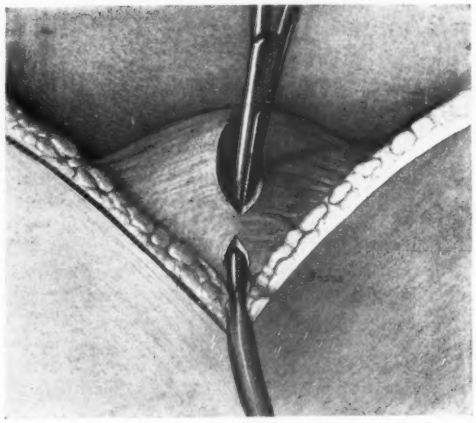


Fig. 11. A counter-opening for drainage of bladder.

technique with no operative mortality. The amount of the bladder wall removed has been extensive in every instance.

In every operation we have been impressed with the comparative ease with which each step of the technique could be carried out, together with the subsequent restoration of bladder function. While the growth has been so extensive in these patients as to almost preclude the probability of cure, the patients have been relieved of many of the distressing symptoms with a return to a condition of comparatively good health.

The field seems a most fertile one for surgical investigation because vesical carcinoma in many cases is a slow-growing neoplasm and remains localized to the bladder for a long period.

We are confident that with early diagnosis and a radical extirpation along the lines indicated, surgery of vesical neoplasms will give an increasing percentage of cures.

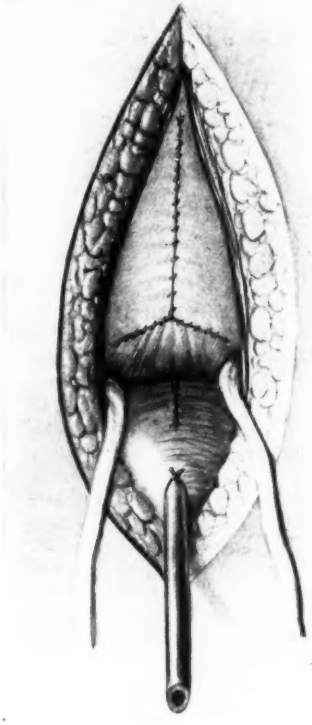


Fig. 12. Accurate closure of peritoneal cavity showing the two cigarette drains and separate stab-wound for drainage of bladder.

REMARKS ON THE SURGERY OF THE ILEOCÆCAL COIL[1]

By FRANCIS REDER, M. D., Saint Louis
Visiting Surgeon, Saint Louis City Hospital

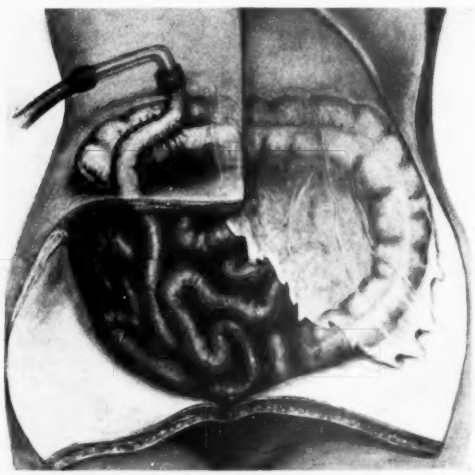
WITHOUT dilating upon the bacterial toxæmia as a direct cause of peritonitis and death in resection of the ileocæcal coil, I desire to dwell upon the operative measures that indirectly seem to harbor a causal factor responsible for so high a mortality.

The death rate of ileocæcal resections for malignant or tuberculous growths coming within the scope of operative mortality has been higher than resections for similar conditions upon other portions of the intestinal tract.

In opining why so high a death rate should attend an ileocæcal resection, I have formulated, as near as my experience has permitted me to judge, a ratio representing the cause of death as one-third attributable to the general condition of the patient, while the remaining two-thirds would fall upon the operative measure employed.

The most important feature for successful surgery of the intestinal tract is an early diagnosis. In how many instances has an early diagnosis been made of a tumor lesion in the ileocæcal region before the growth was sufficiently advanced to be palpable? In this region it appears to me that such a diagnosis has been the most tardy of any. And why? Because the symptom picture, vague in its variations, does not presage the presence of so serious a trouble. It rather invites a diagnosis of intestinal indigestion or chronic appendicitis. The condition is often permitted to go on for weeks and months without even arousing any suspicion on the part of the attending physician. It is usually a dissatisfaction on the part of the patient that eventually causes a new light to be shed upon his condition, or, if sufficient time has elapsed, a mass in the right iliac region having become palpable may give evidence of the nature of the trouble. During the early stage of the disease such patients are seldom sick enough to seek their beds. In fact, they attend to some of their work. The bowel disturbances do not seem to cause much discomfort and the appetite, although impaired, does not disappear entirely. These patients when they reach the surgeon are suffering from a low grade toxæmia and are often profoundly anæmic. They are asthenic and in general present an organism of a low resisting power.

To propose an operative measure for the relief of such a patient involves a problem of no mean import—that of adequately judging the physical forces of the patient. It is a serious matter to subject a patient sick with a chronic lesion of the bowel, and with a wake of toxic symptoms, to an operation fraught with so much shock as a resection. If it could be judged with some certainty that the organism, impaired by disease, would recover sufficiently early from the operative measure offered to successfully cope with the virulent invasion of the colonic flora, the outlook for an operative recovery by the method known as the "ideal" would be very encouraging.



Intestinal anastomosis ileocolostomy with suture, showng the ileal vent. The ileocaecal coil has been resected.

Modified Paul's tube. Introduced through ileal vent into large bowel via the anastomotic opening, a colon tube can be readily passed into the large bowel for purposes of irrigation, etc.

[1]Read before the Southern Surgical and Gynecological Association, Atlanta, December 17, 1913.

This, however, cannot be satisfactorily done, and a patient who was able to walk into the operating room, whose anæsthesia had been good, and whose condition after the ileocæcal coil had been resected was apparently so encouraging that the surgeon without any hesitation completed the operation by making a lateral anastomosis. The "ideal method" may in such instances prove a great disappointment to the surgeon.

To say that the interpretation of an operative recovery of a patient subjected to the "ideal method" of resection of the ileocæcal coil is speculative, is open for criticism. It must be admitted, however, that the patient so operated upon has not been accorded all the factors of safety in connection with this operation.

The great danger following a successful resection of the ileocæcal coil with immediate restitution of the canal lies in the secondary changes which have taken place in the intestinal walls induced by the disease for which the operation was undertaken. The complete atony of the bowel so often present activates various infective processes generated by the pent-up bacteria. Whenever the virulent contents of the bowel become stagnant at the site of suture, the suture frequently yields and a peritonitis, usually incompatible with life, results. One of my cases that bore the gravest aspect developed a fæcal fistula on the fifth day after operation and recovered. This happy termination occurred after a patient had died by the "ideal method" on the ninth day following the operation. It rather demonstrated to me the fact that a vent became almost a necessary adjunct to this operative procedure.

The next ileocæcal resection presented more than the usual difficulties. The condition seemed most favorable for the establishing of an artificial anus. This operative procedure was carried out successfully and the patient made a satisfactory recovery. An endeavor to reëstablish the continuity of the bowel two months later caused the death of this patient from peritonitis. Having had two recoveries with the "ideal" operative measure that proved in no way more severe than a simple appendectomy, I at no time underestimated the difficulties of the choice of an operation for the resection of the ileocæcal coil. The death of the patient from peritonitis, the result of an operative procedure for the correction of an artificial anus, although most deplorable, rather encouraged me in this operative measure and in the last two cases I successfully employed a technique that carried with itself the feature of an artificial anus, but in a modified form. The advantage of this technique is a vent that will not require risky operative measures for its successful closure. The technique is as follows: Incision through the outer edge of right rectus muscle. Ablation of the tumor and the removal of the mesenteric glands. The division of the ascending colon and the ileum is an important feature. Inasmuch as cæcal growths usually embody considerable of the ascending colon, the hepatic flexure may not be far distant. It is of some advantage to make the section of the colon at or beyond the hepatic flexure. The division of the ileum should be such as to give the bowel the necessary latitude to be brought without tension in contact with the colon, near the point of resection. At least six inches of the ileum should be sacrificed. The end of the colon is closed with suture in the accepted manner. The end of the ileum is closed temporarily with a basting stitch so as to avoid spilling any of its infective contents while the operation is in progress. A lateral anastomosis with an opening not less than three inches is performed. With a suture conveniently placed through the serosa of the bowel, the end of the resected colon is secured to the abdominal wall as far laterally as can be done to relieve tension upon the line of anastomosis and possibly anticipate any future displacement of the gut. After the anastomosis is completed, the free end of the ileum is drawn out of the abdomen, is sutured to the parietal peritoneum of the wound into its uppermost corner away from any viscus that may be liable to get caught at the point of fixation, and the abdominal wound is closed. If a more advantageous implantation of the ileal end can be made through a small secondary abdominal incision, this should be done and the primary incision closed completely. The basting suture closing the portion of ileum brought out of the abdominal cavity is removed and a glass drainage tube introduced, thus establishing the desirable vent. This vent will answer the purpose not only in serving as a factor of safety in permitting the immediate escape of the contaminated bowel contents and flatus, but it will also answer the purpose in giving the necessary access for the introduction of saline solutions and irrigations so essential in a condition of bowel atony. The colon, if necessary, and it frequently is necessary, can be readily irrigated by introducing a modified Paul's tube into the lumen of the ileum down to the anastomotic opening leading into the colon. Through this Paul's tube a colon tube can be readily introduced into the large bowel for irrigation.

A disadvantage of this surgical measure is the existence of an artificial anus. Inasmuch as only the ileum is brought out of the abdomen, the artificial anus is one of much lesser magnitude and usually closes within several weeks, without the aid of a severe operative measure. Its advantage of being a factor of safety should overshadow any sense of discomfort it may cause.

Ileocæcal resections:
Deaths—
3 Ideal method.
1 Artificial anus.
Recoveries—
2 Ideal method. (One developed fistula 5 days after operation.)
1 Artificial anus.
2 Writer's method.

THE EVOLUTION OF THE TONSIL AND ADENOID OPERATION, AND A DESCRIPTION OF THE WRITER'S METHOD OF PROCEDURE

By JOSEPH C. BECK, M. D., Chicago

THE earliest operative procedure for removal of the faucial tonsil dates back to the time of Celsus, who advised finger enucleation; but subsequent methods consisted principally in removal of portions of the tonsils — tonsillotomy. Without going into a detailed description of these antiquated methods, to which, however, we wish to acknowledge our indebtedness in developing better methods, we will briefly mention the most important modifications by illustrating the instruments (Figs. 1 to 5).

Intentional tonsillectomy, so far as the literature shows, was performed first by E. Pynchon of Chicago, by the electrocautery dissection, and by the cold method, using the knife or snare or both, by William Ballenger of Chicago. I say intentional tonsillectomy, because almost everybody removes tonsils with capsules intact by tonsillotomes or snares accidentally in those cases that have very loose attachment to their surrounding structures.

At about the same time a large number of laryngologists in America took up the subject of tonsillectomy, and the literature began to beam with modifications of operative procedure for the complete enucleation of the tonsil. Finger dissections, without preliminary dissection of the pillars, became quite popular in the East, advocated by Mithofer and Richardson, and about that time appeared the present writer's article on tonsillectomy by sharp instruments, and immediate hæmostasis by angiotribe while dissecting. Freer's systematic technique of dissection by sharp instruments appeared soon after. The dissection by means of a dull spoon or dissector, by McWinney came into prominence, especially in New York City, and was successfully practiced all over this country. For several years these various modifications (and many more could be added) were practiced by most of the laryngologists and by many general men.

Following these operative procedures, the observations were made and published by many that considerable scar formation resulted from final cicatrization between the anterior and posterior pillars, and that the anterior pillars particularly were oftentimes so agglutinated to the markedly thickened posterior pillar as to be entirely lost in their outline. To this condition Hudson-Makuen and Stucky called especial attention, although every operator observed it. Since it caused very little or no difficulty, there was little attention paid to it, especially since the local and systemic results from the complete removal of the tonsils were so satisfactory.

When Greenfield Sluder presented the subject of intentionally removing the tonsils without preliminary dissection of the pillars, etc., by the aid of one instrument and the employment of a constant anatomical point on the lower jaw, "the eminentia alveolaris or hump" corresponding to the last molar tooth, an entirely new departure from the accepted technique took place. Most of the laryngologists discredited, at first, the possibility of such a procedure, knowing how difficult it was at times to dissect a tonsil with the aid of several instruments and the forcible traction on the tonsil. Not until Ballenger informed us of the possibility of doing the Sluder operation were we willing to try it, and in the first few instances we found it not at all satis-

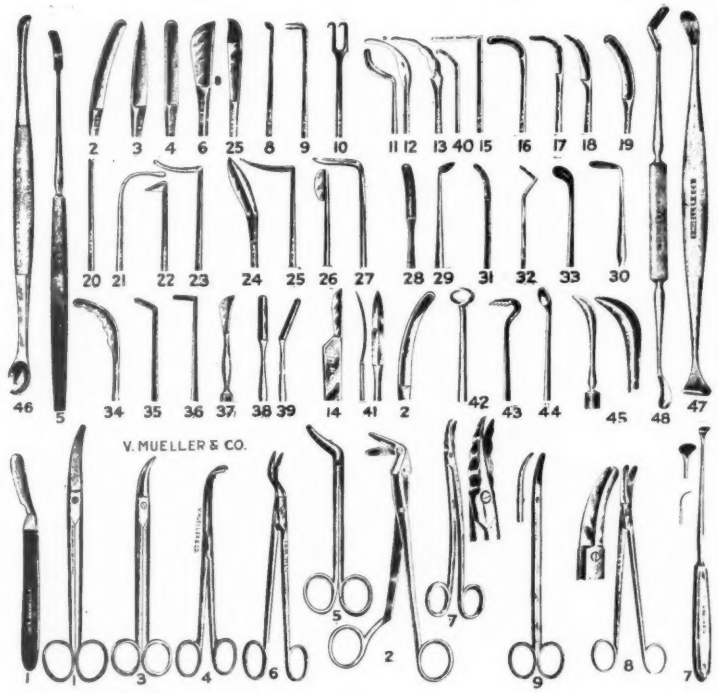


Fig. 1.

TONSIL KNIVES, DISSECTORS, ETC.

1. Bacon's
2. Hobbs'
3-4. Greene's
5. Robertson's
6. Beck's No. 1
7. Pierce's
8. Abraham's Curette
9. Boettcher's Hook
10. Plain Hook
11. Hager's
12. Robertson-Allport's
13. Allport's wave-edged
14. Ballenger's
15. Swan's wave-edged
16. Killian's
17. Tyding's
18. Canfield's
19. Greene's R. & L.
20. Swan's plain
21. Schmied's Dissector
22. Kyle's
23. Leland's Original
24. Pynchon's
25. Leland's Improved
26. Ballenger's
27. Pond's Dissector
28. Seiler's
29. Freer's No. 1
30. Freer's No. 2.
31. Day's No. 1.
32. Stevenson's
33. Carney's
34. Gwinn's
35. Day's No. 2.
36. Day's No. 3.
37. Beck's No. 2.
38. Dean's Straight
39. Dean's Angular
40. Douglas's
41. Good's
42. Barter's Tenacula
43. Dickinson's Retractor
44. Ballenger's Curette
45. Greene's Dissector
46. McWhinnie-Hurd Dissector
47. Hurd's Dissector and Retractor.
48. Carpenter's Dissector

TONSIL SCISSORS

1. Fenger's 2. Robertson's 3. Prince's 4. Griffin's 5. Farrell's 7. Windle's 8. Boettcher's 9. Metzenbaum's

factory. Not that it was impossible, but it required considerable force in the manipulation, using the original dull-bladed instrument recommended by Sluder, particularly when adhering to the anatomical principle of bringing the tonsil over the hump of the lower jaw. We also found that very frequently the blade would not cut through, so that a knife had to be employed in addition to cut it loose at the upper and lower extremity. While experimenting with this operation we found that we could ignore the hump on the lower jaw, since the latter, when the mouth was opened by a mouth gag, was much too low for the tonsil to be dragged over in a good many instances, especially when we had a tonsil with a high velar lobe.

Consequently, we adopted the uniform technique of lifting the tonsil forward and upward by means of the instrument, and then with the finger pushing or feeding the tonsil through the ring, cutting it off by means of a sharp blade. When Ballenger modified the Sluder instrument, we adopted that, because the operation was easier to perform by means of that instrument. We

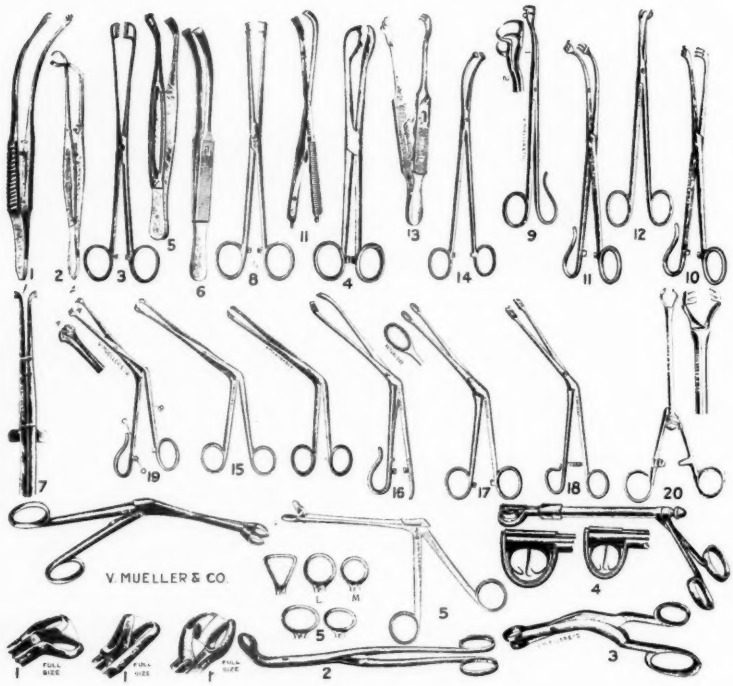


Fig. 2.

TONSIL FORCEPS

1.	Faenger's	6.	Robertson's	10.	Andrew-Pierce's	14.	White's	18.	Boettcher's
2.	Beardsley's	7.	Peters'	11.	Ballenger's	15.	Tyding's	19.	Tivnen's
4.	Ingall's	8.	Musseure's	12.	Dean's	16.	Richard-Moraweck's	20.	Hurd's
5.	Pynchon's	9.	Casselberry's	13.	Colliver's	17.	Brown-Mial's		

TONSIL PUNCHES

1.	Miles'	2.	Rhode's	3.	Rault's	4.	Robert-Mueller's	5.	Hartman's

still had a very disagreeable difficulty with the operation, and that was the apparent sudden hæmorrhage, which is not a hæmorrhage at all, but a sudden liberation of all the blood-vessels that are intimately connected with the tonsil.

The addition of a snare to the Sluder instrument was recommended for the purpose of controlling the bleeding, and though we found it cumbersome, still the bleeding was considerably less than by the Sluder-Ballenger instrument. This led us to the development of the instrument which we called the tonsillectome (Fig. 6), which is nothing more than a snare supplied with a ring that has a groove for the hiding of the wire loop, adopting the Sluder technique in the main, with the exception of ignoring the hump on the lower jaw and lifting the tonsil upward into the supratonsillar fossa. This operation and instrument have been described elsewhere[1] and we have been employing it ever since with excellent results and with practically no changes. There have been a few important and interesting observations made, which we will mention at this time, and also briefly describe the procedure in connection with the adenoid operation, since the tonsillectomy and adenectomy are usually performed at the same time.

We have adopted this rule: Whenever we could Sluderize a tonsil (that is, were able to push it through the ring without undue force) we would employ the tonsillectome. This is possible in more than 85 per cent of the cases. If, however, this did not occur, we would resort to the sharp dissection rather than succeed and traumatize the tissues.

[1] J. Am. M Ass., 1912, lviii, 240.

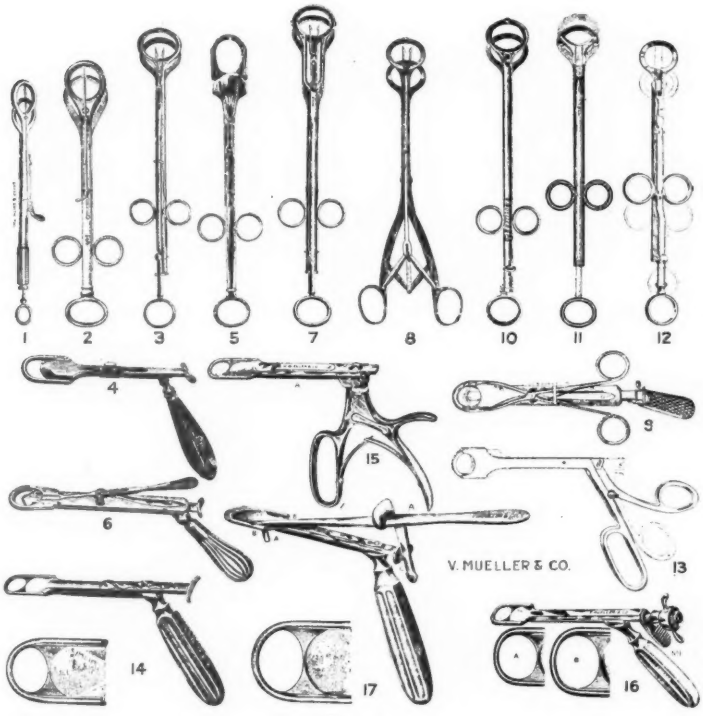


Fig. 3.

TONSILLOTOMES AND GUILLOTINES

1. Fahnenstock's
2. Fahnenstock's Improved
3. Mathieu's
4. McKenzie's
5. Billing's
6. Gunn's
7. Larayenne's
8. Windler's
9. Hamilton's
10. Casselberry's
11. Simplex
12. Ermold's
13. Ballenger Ecraseur
14. Sluder's Guillotine
15. Sluder-Ballenger Guillotine
16. Sluder-Sauer Guillotine
17. Sluder with Mechanic's Dog

We have formulated some of the reasons why some tonsils are difficult of Sluderization, and consequently are not adapted to this method of operating. One of the most frequent causes is previous peritonsillar abscess with subsequent marked adhesions, especially if the case was incised before the abscess became fluctuating, or if the incisions were made in regions where the abscess was not pointing. Second, in cases in which there had been previous attempts at tonsil dissection (not tonsillotomy). Third, under local anæsthesia or incomplete relaxation in general anæsthesia. Fourth, where there is a very long and slender portion of the tonsil below the level of the base of the tongue. Lastly, in the rare cases of markedly short palatoglossus muscles, occurring twice thus far in our experience.

We have further found that the small size instrument that was first devised for this operation, considered by those who had no experience with it as too small, was too large in some of the small submerged tonsils, especially in small children, and we were compelled to employ a much smaller ring. One must remember that the proper eversion of the tonsil from its capsule depends on the purchase of its cryptic face on the entire circumference of the ring. This will cause the tonsil to come through with a sort of thud.

The question of bleeding is always important in all tonsil operations, and in this procedure we have found that the average bleeding is less than by any other method. There are, however, cases in which the bleeding is quite brisk. We believe that this primary bleeding depends on the pathological condition of the throat at the time of the operation: (*a*) if tonsillectomy is done too soon after an acute attack, the bleeding

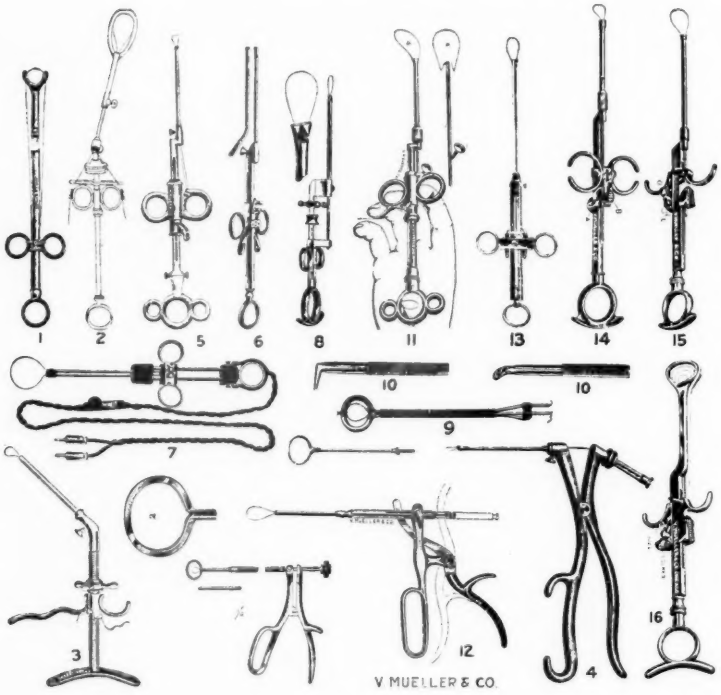


Fig. 4.

TONSIL SNARES

1. Pierce's	5. Farlowe's	9. Knight's Electric	13. Bruening's
2. Ingall's	6. Menge's	10. Pynchon Tonsil Electrodes	14. Martin's
3. Bosworth's	7. Gradle's Electric	11. Farlowe Boettcher	15. Pierce-Mueller's
4. Peters'	8. Pynchon's	12. Tyding's	16. Beck-Mueller Tonsillectome

will be more profuse; and (*b*) the anatomical distribution and the size of the vessels are also not the same in every case, and much depends on this condition as to how much bleeding occurs.

The point of reaction of the surrounding tissues of the tonsil is of great importance, since the degree of secondary contraction will be proportionate to the amount of inflammatory reaction. In this operation there is less reaction than in the ordinary sharp or blunt dissection, but more than the sharp Sluder operation.

As to the point of destruction of vital structures, as muscles and mucous membrane of the pillars, we find that in this operation there is absolutely no mucous membrane or muscle involved, and one will find the capsule of the tonsil smoother than in any other method of tonsillectomy.

The very important point in this, as in any other method of tonsillectomy, is the necessity of experience before judgment can be passed upon the value of this procedure. The first few cases will perhaps be failures, especially so far as the lower pole of the tonsil is concerned, and especially if one will insist upon operating tonsils which do not Sluderize easily and should really be dissected.

The various criticisms against this as well as the Sluder procedure are usually based upon inexperience, and purely on theoretical grounds. As said in the beginning, it does not seem possible to one who has been doing tonsillectomy only by the dissection method. The criticism from Vienna, by Tanzer and Weil, is particularly unjust to the method, and we are quite sure that these opinions will not influence those that will try the Sluder operation or any of its modifications.

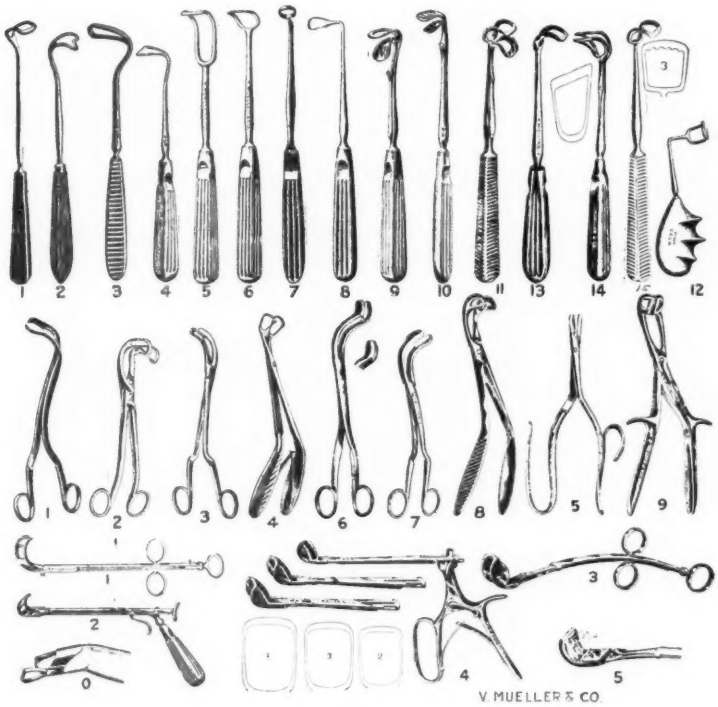


Fig. 5.

ADENOID CURETTES

1. Gottstein's
2. Munger's
3. Owsley's
4. Schmied's
5. Kirstein's
6. Beckmann's
7. Maier's
8. Krause's
9. Delstanche's
10. Delstanche's Improved
11. St. Clair Thompson's
12. Fine's
13. Barnhill's
14. Todd's
15. Beck's

ADENOID FORCEPS

1. Löwenberg's
2. Inrasz's
3. Menier's
4. Gradle's
5. Ingall-Freer's
6. Quinlan's
7. Prince's
8. Brandegees'
9. McAuliff's
10. Musson's Curette

ADENOTOMES

1. Schuetze's
2. Gradle's
3. La Force's
4. La Force's Universale
5. Stevenson's

Among the accessories that we employ in the tonsil operation which are important to success is the anæsthetic. We employ ether exclusively, after having tried gas-oxygen for some time, because we find that the latter does not completely relax the pharyngeal muscles, which is necessary to the tonsillectomy, and even more so to the adenectomy, as will be shown later.

To induce anæsthesia we employ what Rovsing has recommended — "the rebreathing of ether," with a somnoform apparatus. About two ounces of ether is placed in the rubber bag, and, after applying the mask firmly over the face, and about the nose and mouth, the air valve is opened and the patient breaths air and a small amount of ether. When the air valve is partly closed, the ether vapor is increased, until finally the valve is entirely closed and the patient breathes pure ether. This he continues to do, when finally a quantity of CO_2 will form within the bag. This is called the rebreathing of ether, since the patient exhales some of the excess. The CO_2 is considered of benefit to a certain degree in ether anæsthesia, and whenever it accumulates to an excess the patient becomes cyanotic. The air valve is then opened and some air allowed to be breathed in. This method of induced anæsthesia we have found to be the

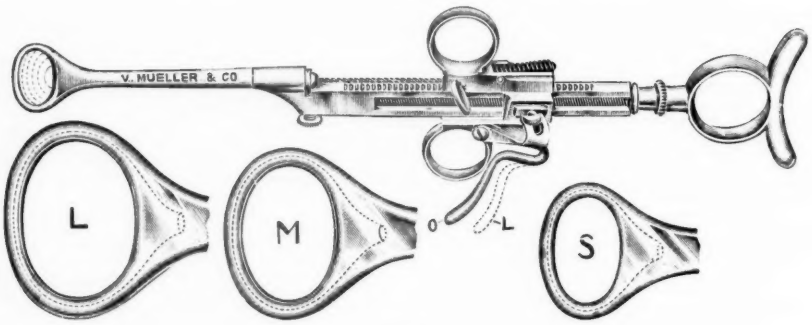


Fig. 6.

Fig. 6. Instrument, developed by the author, which has been named the tonsillectome. It is simply a snare supplied with a ring that has a groove in it for hiding the wire loop. In its use the Sluder technique has been adopted with the exception of ignoring the hump on the lower jaw and lifting the tonsil upward into the supratonsillar fossa.

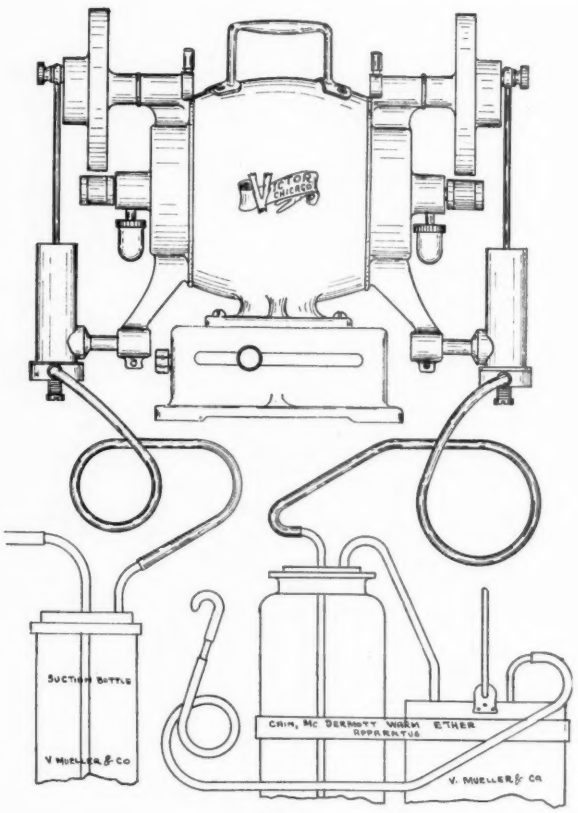


Fig. 7.

Fig. 8.

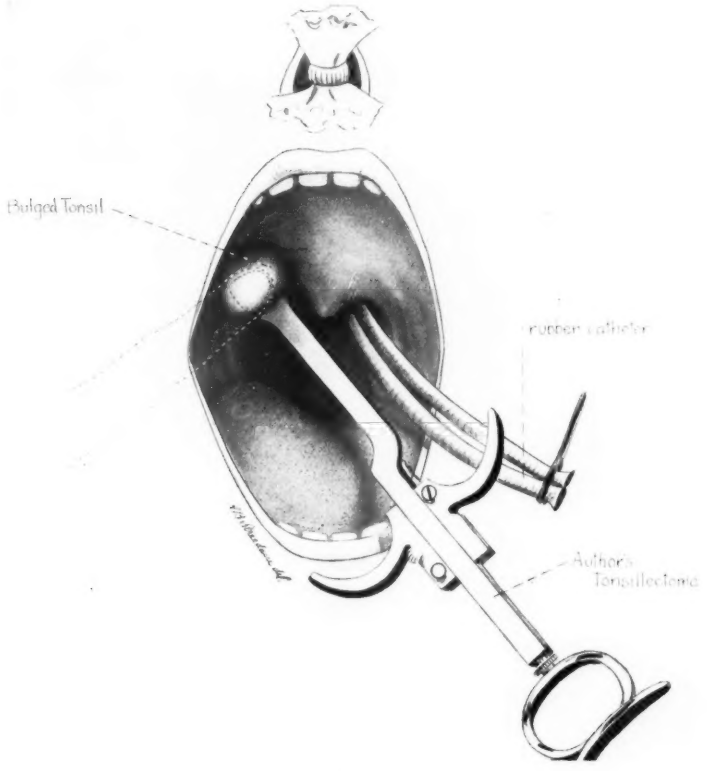


Fig. 9.

least irritating and most satisfactory, although it requires a little longer than the pouring or drop method. The induced anæsthesia is then followed with the forced vapor method.

For this purpose we use an apparatus (Fig. 7) consisting of a Victor motor to which are attached two separate pumps, one to the suction apparatus, the other to the ether bottle. This vaporized ether is forced through a small tank (Cain McDermot), which contains wound within it about twenty feet of tubing, surrounded by thermolite. This tank is hermetically sealed, and when placed in hot water for about ten minutes heats up the thermolite, the latter holding the heat for some time. The ether which is passing through the heated tubes within this tank thus has its chill taken off and is easier for respiration, absorption, and less irritating to the mucous membrane of the respiratory tract. From this tank passes the ether supply tube and its terminal mouthpiece. This latter acts also as a cheek retractor, permitting better inspection. There is also present another bottle for the purpose of suction of blood and mucus. From the suction pump goes a stiff rubber tubing to the suction bottle, and from the latter another rubber tubing with a metal tip, to be introduced into the throat, etc., whenever indicated. The suction is one of the greatest aids in the operation of tonsillectomy and adenectomy.

Atropine before operation is a distinct aid, but we have had the reverse experience in several cases of very young children (that is, near the three-year age), who did very poorly with the anæsthetic when they received atropine, even as little as $\frac{1}{200}$ gr. The symptoms were that of slow breathing and very deep anæsthesia. We, therefore, never employ it in these cases, and it is less necessary, since suction is employed.

The general preparation of a patient for a

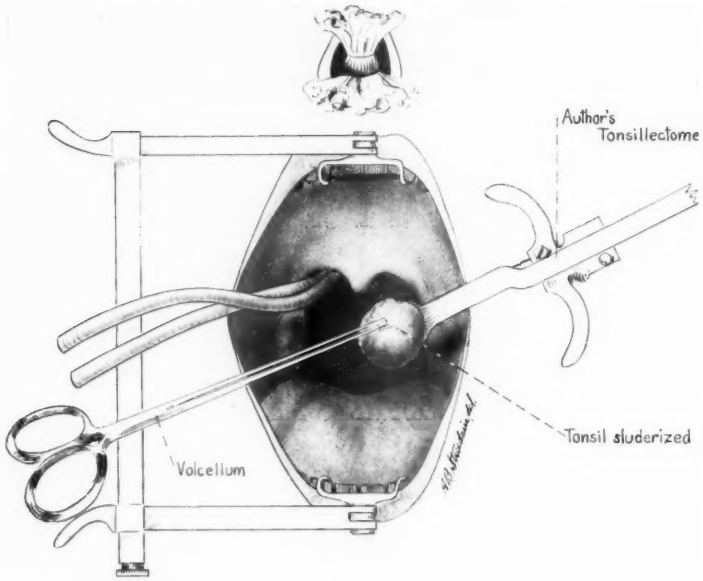


Fig 10.

tonsillectomy is the same as for any major operation, and we insist that the patient be in the house not less than six hours before operation and three days thereafter.

THE ADENOID OPERATION

The first record of the rational removal of the adenoids is by Meyer,[1] and this was performed by means of his small ring knife passed through the anterior nares; but for the longer period a curette, as devised by Gottstein and modified by many, has been employed for the removal of the adenoids. In fact, it is still the instrument of choice by the majority of laryngologists, and the results are in most cases satisfactory. We will again illustrate the principle of the various instruments and modifications rather than go into a detailed description. (Figs. 1 to 5.)

Löwenberg was one of the first to devise a forceps to remove the adenoids piecemeal, and after that many modifications were described.

Gradle and Schuetz were the first to describe a sort of a guillotine, called the adenotome, and this was modified by Passow, and finally La Force, whose instrument became very popular, especially in this country.

In this connection, I wish to state that the operation of tonsils and adenoids as performed by the general practitioner, or rather to be performed by him, is absolutely essential, especially in country districts or in localities far away from the location of an otolaryngologist. In view of that fact, it is my opinion that such operation on the tonsils and adenoids, which will enable these same general practitioners to do the most satisfactory operation with the least amount of traumatism, is the best procedure that we can advise; and that is true of the use of the adenotome, especially the one devised by La Force for the removal of adenoids, and the Sluder principle, especially the one that I have adopted and will describe, for the removal of the tonsils.

While we admit that the La Force adenotome appeared to avoid the possible complications caused by the curette—namely, injury to the septum, as was possible with forceps, too deep a removal of the adenoid, shredding of the mucous membrane of the posterior pharyngeal wall and allowing the formation of tags — still, it did not appear to do a thorough removal, especially in the region of the eustachian tube and septal region of the vault. To overcome the former difficulty, Freer has developed a technique for the removal of the adenoid by the nasal route, by means of a special devised biting forceps. A small ring

[1] Arch. f. Ohrenheilk., 1873, 1874.

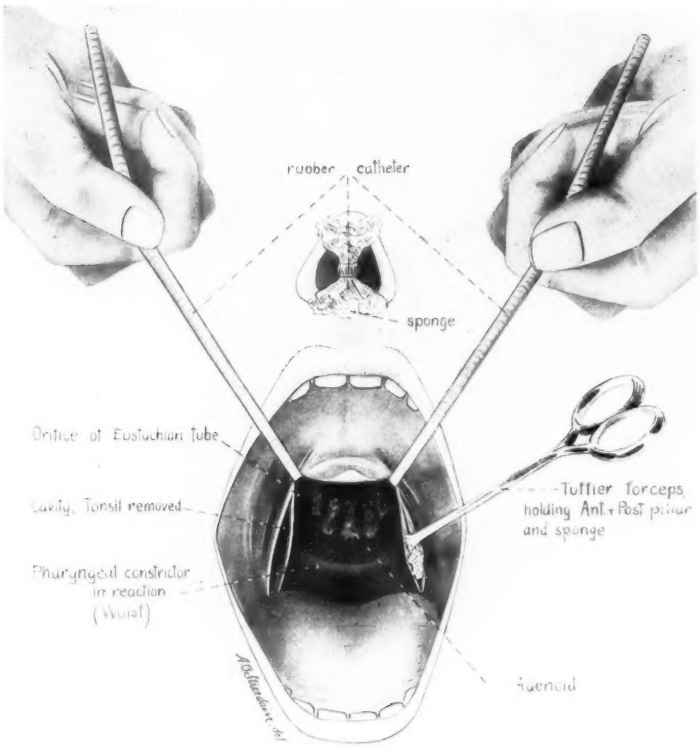


Fig. 11.

curette had been recommended by Meyer for the nasal route, and recently a specially curved ring curette has been recommended by Holmes, to be used by the aid of the latter's nasopharyngoscope.

We have felt that the adenoid operation was the most unsatisfactory procedure in laryngology, in that the work was done blindly and the results were far from perfect. There were several objections in particular, and in developing a technique we strove to overcome them, and believe we have succeeded fairly well in doing so. In the first place, as to inspection of the region: this we accomplish by passing a small size rubber urethral catheter, one end through each nostril and out of the mouth. Holding these free ends in the left hand and pulling over the upper lip will bring the greater part of the postnasal space into plain view. By the aid of a large laryngeal mirror one will be aided in seeing the posterior choanæ and the extreme lateral aspect of the nasopharynx. The eustachian orifice can be seen directly by slight additional extension of the head a little to one side. One of the most interesting and surgically important points was brought out in the development of this part of the technique, and that was the enormous size, at times, of the half a ring, or projection (Wulst), that formed on the posterior pharyngeal wall just out of sight when operating by the ordinary method, especially when the patient is partially or not at all anæsthetized. This half a ring, or projection, is formed by the constrictors of the pharynx in the reflex action in the act of swallowing, or the moment the posterior wall is touched. It was a perfect revelation to us to note with what frequency this muscle was injured in the usual method of operating, when we would inspect by this palatal retraction after operation. We believe that the soreness in the act of swallowing, complained of so often after the adenoid operation, is not

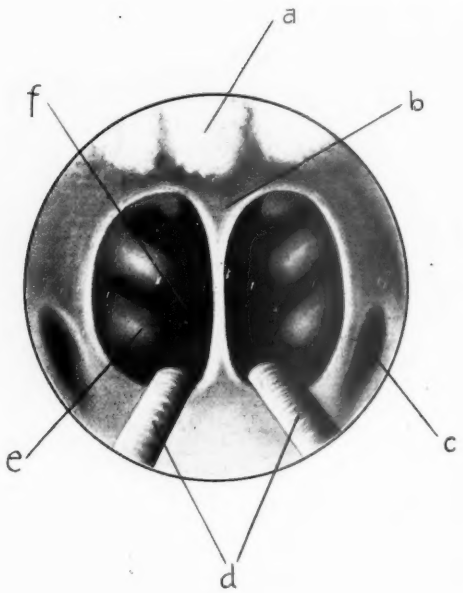


Fig. 12.

from infection, but from the injury of the constrictor.

The next point is the method of removal. It has been the custom to remove as large a piece of the adenoid as possible with the first sweep of the curette in the median line, and then, usually in a cursory way, to make a few passes with the curette on the side.

The next point was to control the bleeding, that is usually left to stop spontaneously. While this usually occurs, and not much blood is lost, still it is more than is necessary, and it certainly detracts from the operation from the surgical standpoint to allow the bleeding to stop spontaneously. The bloody appearance of the field at and after an adenoid operation, or the sight of a child turned over the edge of the table to allow the blood to flow into the bucket, always had a depressing effect on the writer. During the operative procedure, the suction apparatus keeps the field clear of blood, and as soon as the adenoids are thoroughly removed, a sponge mounted on an artery forceps is passed into the nasopharynx to control further bleeding by pressure. Removing this sponge, and finding that bleeding has not stopped, one will usually observe one particular point of oozing, and that is in the median line. A straight artery forceps, or even two or three, applied to these bleeding points will always stop it permanently. All bleeding must be stopped before patient is returned to bed. The same is true with the forceps or the adenotomes. We have found in the immediate examination by means of our palatal retraction after such operation a denuded area, with the muscles bare — and to a greater degree than necessary. At the same time, very frequently masses of adenoids are left in the regions where they do most harm — that is, in the region of the eustachian tubes. Usually the nasopharynx and nares were filled with a blood-clot, and many times little tags of adenoids were seen. In one case the posterior lip of the eustachian tube was cut off. Aside from wanting the adenoids for histologic examination, or that one may be able to demonstrate to the parents that the adenoids were removed, there is no reason why we should remove one large mass with this large exposure of the muscles, which will surely require longer to heal.

The instrument that I now employ for the removal of the main mass is an adenoid curette of the St. Clair-Thompson pattern, without a guard, and with the cutting edge formed into a wave blade (Fig. 8). The motion of the instrument in the removal of the mass is not in the usual rapid, sweeping movement of the elbow-wrist turn, but is from side to side and slow elbow-wrist turn. The mass is cut off and remains lying practically *in situ;* however, the last cut at the lower margin of the mass may require the use of a forceps to hold it. Shredding of the mucous membrane is not possible under these circumstances, nor it is possible to cut off any of the muscle fibers of the constrictor fold, as I have seen in the operation when done by feeling alone.

The pressure exerted is very slight, since there is no attempt made to remove the entire mass at one time, but simply to shave down to the fibrous wall, which is situated on top of the muscles. We may say that we curette the post-nasal space as one would a uterus. To the side of the nasopharynx, in the region of the Rosenmüller's fossa, we employ any small straight ring curette or a spoon.

The only departure from the above procedure is when it is desired to procure a mass of adenoid tissue for demonstration or examination purposes. Then the La Force adenotome is used without much pressure, and the operation completed in the regular manner.

The important practical factors in this technique are, therefore:

1. Perfect direct and indirect inspection.
2. Protection to the constrictor muscles of the pharynx and the ability to judge when a patient is thoroughly asleep.
3. Thorough surgical curettage.
4. Control of the bleeding and subsequent inspection of the bloodless field of operation.

Steps in the technique of the tonsil and adenoid operation.

(*a*) Patient in the reclining position.
(*b*) Induce anæsthesia.
(*c*) Mouth gag applied.
(*d*) Forced vapor anæsthesia.
(*e*) Pass the rubber catheter, and hold the free ends by artery clamp to one side; place a piece of gauze between the catheter and the septal columella (Fig. 9).
(*f*) Remove the secretions and blood by suction whenever accumulated in the pharynx. (Do not leave the suction tube in the oral cavity, else the patient will not receive enough ether vapor, because it will be sucked out.)
(*g*) Remove right tonsil (Fig. 9).
(*h*) Draw forward on the rubber catheter. This stops the supratonsillar bleeding and brings the posterior pillar forward, making a perfect isolated pocket of the tonsillar wound.
(*i*) Grasp edge of anterior pillar by a small rat-tooth forceps (Tuffier).
(*j*) Place a loose gauze sponge into this pocket and grasp the edge of the anterior and posterior pillars, including a small bit of gauze to prevent its slipping out below.
(*k*) Remove the left tonsil (Fig. 10), and repeat the same technique as *g*, *h*, *i*, and *j*.

Now you may operate on the adenoids or remove the gauze sponges first from the right and then the left, or vice versa, again grasping the edge of the anterior pillar (but do not bring forward the catheters), and inspect the cavity for bleeding. If there are any special spurters or marked oozings, then one may either grasp them with artery forceps or repack with gauze and hold by the Tuffier forceps. There is a preference in removing these gauze inlays before operating on the adenoids, because better exposure is obtained, especially of the eustachian orifice region.

(*l*) Draw the free ends of the catheter over the upper lip and slightly outward (Fig. 11). If the uvula is very long or in the way, one may grasp its tip with the Tuffier and hold it upward and forward.
(*m*) Inspect the eustachian orifice and posterior surfaces of the posterior pillars from the side, and the posterior wall and vault from in front. Extension of the head helps some.
(*n*) By means of a large laryngeal mirror inspect indirectly the posterior choanæ and the extreme upper part of the vault (Fig. 12).
(*o*) Remove the adenoid.
(*p*) Check the bleeding.

NOTE.— Since reading this paper the author has had occasion to operate on cases with definite history of hæmophilia, leucæmia and marked arteriosclerosis and has employed his method of tonsillectomy with the tonsillectome, only employing the hot wire instead of the cold. While the number of cases operated are still few in number, it is sufficient to say that in every instance the removal of the tonsil is followed by absolutely no bleeding. The resultant cavity of the tonsil wound appeared to be very shallow and has a seared appearance. The resultant reaction of the soft palate and surrounding tissue was no greater than when the cold snare was used, but the patient expressed a feeling of considerable more stiffness of the movement of the jaw after operation and lasting longer than when the cold snare was employed.

The great inconvenience in trying the instrument was the breaking of the wire or burning through.

In addition Dr. La Force has recently devised an instrument for the same purpose of doing a practically bloodless operation by the cold method which I have tried and found as the author states.

THE USE OF THE WIRE TOURNIQUET IN OPERATIONS FOR GOITER [1]

By LEONARD FREEMAN, M. D., Denver, Colorado

THE ideal goiter operation should meet certain requirements: The average surgeon of limited experience should be able to perform it with rapidity, safety, and confidence; hæmorrhage should be easily and perfectly controlled; there should be no danger of injuring the parathyroid bodies or the recurrent laryngeal nerves; crushing or excessive manipulation of the tissues should be avoided, especially when a tendency to hyperthyroidism exists; and it should be possible to remove with facility as much or as little of one or both lobes as may seem desirable.

The methods in general use fall so far short of this ideal that many otherwise skilful surgeons approach operations upon the thyroid with hesitation, which naturally tends to direct much of the goiter work into the hands of men of special training and experience.

I desire to call attention to an operation, devised several years ago by myself, which in most cases meets the above requirements better than any other procedure with which I am familiar:—[2]

Operation. The gland is dislocated in the usual manner through a collar incision. This means that the lobe to be removed should be freed bluntly, generally by sweeping a finger around it next to the capsule, and lifted from its bed. This usually can easily be done so that the lobe may be grasped by the fingers, thus putting its attachments on the stretch and forming more or less of a pedicle next the trachea (Fig. 7).

Several loops of heavy braided silk, or better, strong fishing line, are then drawn through the substances of the lobe near its attachment. This may conveniently be done by plunging a small pair of blunt-pointed "alligator forceps" (Fig. 1) through the gland, grasping at its center a ligature a foot long and dragging the loop into position. Several loops are required — one near each end and one or more in the center, according to the size of the goiter (Fig. 4). If more convenient both ends of a loop may be threaded through the eye of a large round needle (Fig. 2), which is then passed blunt end first through the glandular tissue; or an ordinary probe with an eye at one end may similarly be used.

As soon as the loops are in place, two wires are adjusted, one on either side of the lobe, and tied tightly in place by means of the ligatures, thus forming a sort of tourniquet which compresses the base of the lobe firmly enough to control the circulation without crushing the tissues. This is easily accomplished by passing one wire through the closed ends of the loops, and upon the opposite side tying the loose ends firmly over the other wire (Figs. 3, 4, 7). Additional security may be obtained by again tying the loose ends of the two outer loops around the wires as they project beyond the gland (Figs. 3, 5, 6) and this should generally be done. If bow-knots are used they may be untied and the loops tightened, if the tourniquet should prove to be too loose after amputation of the tumor, as might rarely occur in the larger and softer goiters.

The size of the wire should be about No. 17. It should be capable of being bent without bending too easily. The German silver wire employed by dentists ("orthodontia wire") answers the purpose admirably. With a pair of cutting pliers the wires may be cut to appropriate lengths during the operation, and perhaps bent to suit the requirements of special cases.

As soon as the tourniquet is properly applied, which can be done very quickly, the distal portion of the gland is cut away to any desired extent without the least fear of hæmorrhage. The wound is next rapidly whipped over-and-over with catgut in a round needle, so as to cover in the raw surface and prevent subsequent bleeding. The application of this hæmostatic suture will be facilitated if a sufficient stump is left beyond the wires and especially if the excision is made slightly deeper in the center than at the edge (Figs. 5, 6). The wires are then pulled out of the loops, thus freeing the latter so that they may be picked from the tissues; or, if the wires stick, the loops may be cut.

In the majority of instances the procedure goes surprisingly easily and rapidly, and after the gland has once been dislocated it is generally unnecessary to use either artery forceps or ligatures. Whether or not the superior thyroid arteries are separately tied is largely a matter of choice. I formerly brought the ends of the wires out through the skin incision and left them in place for several days before removing them,

[2] Described in a paper read before the State Medical Association of Texas, May 9, 1911.

[1] Read before the Western Surgical Association, St. Louis, December 19, 1913.

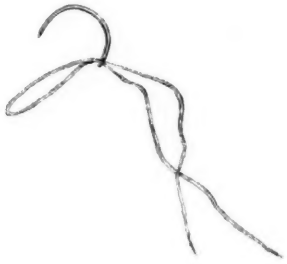


Fig. 1. Fig. 3. Fig. 2.

Fig. 1. Small alligator forceps for pulling loops through gland. Fig. 2. Needle threaded with loop to be inserted blunt end first. Fig. 3. Showing wires held by loops, additional turns being taken at each end.

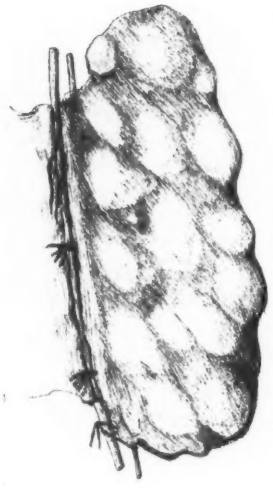


Fig 4. Fig. 5. Fig. 6.

Fig. 4. Wires in place with loops tired. Fig. 5. Lobe removed leaving grooved pedicle. Note extra turn of end ligatures around extremities of wires. Fig. 6. Raw surface whipped over with running suture.

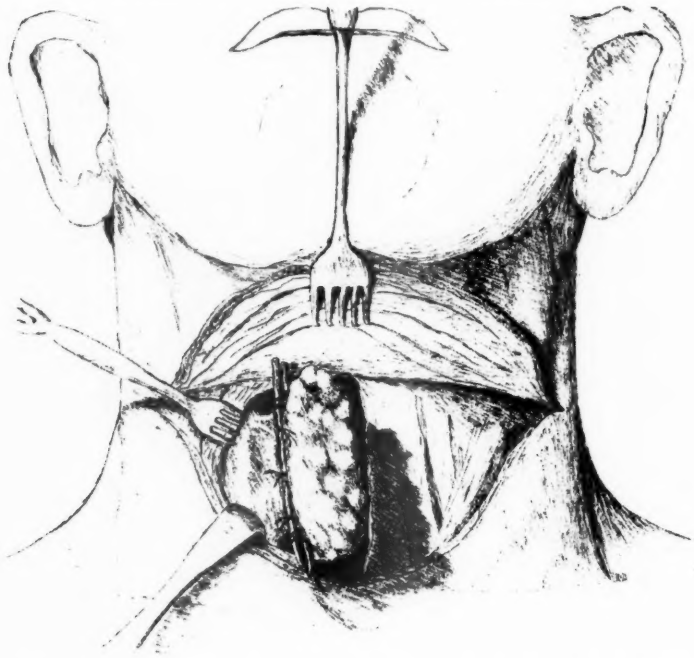


Fig. 7. Showing wire tourniquet in position ready to remove lobe. Note additional turns of end loops around extremities of wires increasing efficiency of tourniquet.

using, of course, absorbable loops of catgut, but I have long since discarded this more cumbersome method in favor of the immediate hæmostatic suture, although it might occasionally be useful when the tissues were particularly friable.

The wire tourniquet has a number of advantages:—

1. It may be adjusted to almost any goiter — by bending the wires if required, although this is seldom necessary.

2. The control of hæmorrhage nearly always is perfect, so that the gland may be sliced off beyond the tourniquet with absolute confidence.

3. The tissues are not crushed — simply constricted, which is of importance in Graves' disease at least.

4. There is no danger to the recurrent laryngeal nerves or to the parathyroids. Even if they should be caught in the grasp of the wires, which is unlikely, the compression would not be great enough to do them permanent injury.

5. There is no chance of the wires slipping from the stump after resecting the gland, as might a pair of forceps, because they are held in place by the loops passing through the base of the lobe.

6. The wires are much narrower than the blades of a pair of forceps and take up less room.

It may properly be asked why an ordinary pair of forceps can not be used instead of a wire clamp. There are several reasons. One is that forceps cannot always be applied, owing to the varying characteristics of goiters and the parts which surround them; another is that forceps crush the tissues and may injure the nerves or the parathyroids, while a third objection is that when the lobe is cut away the forceps, having nothing to hold them, may slip from the stump and permit embarrassing bleeding.

I have used this method in some twenty goiters of various kinds, where it seemed to be indicated. The operations proceeded easily, safely, without anxiety, and there were no fatalities.

The procedure is particularly adapted to parenchymatous goiters, of moderate size and excessive vascularity—as in Graves' disease. It might be difficult to use in large goiters, and it would often be unnecessary in the simple enucleation of cysts and tumors. It saves the use of innumerable hæmostatic forceps, the loss of considerable blood, as well as time and labor.

TWO-TIME TREATMENT OF ENCYSTED PERITONEAL ABCESSES

By W. A. BRYAN, F. A. C. S., M. D., Nashville, Tennessee

FROM the standpoint of treatment and, I may add, of prognosis, encysted abscesses of the peritoneum are divisible into two classes; viz., those in which the abdominal wall limits the abscess and those in which the abscess is walled off by adherent viscera leaving the abdominal wall free from any connection with the abscess, an arrangement in which the abscess may be looked upon as sustaining a relation to the abdominal wall similar to that of any normal viscus. Hence, in the former type, if rupture toward the abdominal surface should occur, it would permit a direct escape of the contents on the integument, while if the same direction of rupture should obtain in the latter type, the pus could only escape into the free peritoneal cavity.

Likewise from the point of prognosis, no one would hesitate to say which of the two he would prefer to deal with or in case of one's own person to have. In the first type there would be a simple incision and drainage with no fear of peritonitis, and in the latter either the pursuit of a devious time-consuming approach along a route not admitting pus to the general cavity, or a change of the whole plan of operative procedure, which is time-consuming and attended with increased surgical risk in the case of weakened patients; or, as is so often done, drainage across the free cavity, which is always necessarily imperfectly, often even poorly, protected from the abscess contents by the wall of packing which surrounds the space lying between the opening in the abdomen and the opening in the abscess. Not a little mortality will be found attending the latter plan of procedure, and it will be higher as the operator is less skillful in abdominal work. While operating some months ago upon a patient of this kind, it occurred to me that it would be much safer if possible to convert type number two into type number one and that this would save time and the need of doing additional trauma by dissecting the peritoneum up until the abscess could be drained extraperitoneally. Surgeons have done two-time operations for similar conditions elsewhere, for instance, for abscess in the liver,—why not here? A favorable point was selected for opening the abscess, the intestines were pushed aside as much as could be safely done without a rupture of the abscess and a ring of gauze placed around this selected spot between the abscess and the parietal peritoneum, the opening in the gauze ring coinciding with the abdominal incision. In a few hours a wall of lymph seals the parietal to the visceral peritoneum and securely walls off the free cavity, so that abscess number two has been converted literally into abscess number one and thereby rendered safe. Access to the proper point for puncture of abscess is made easier by placing a second plug of gauze through the wound and in the center of the ring, like a stopper in a bottle; this is to be removed at the second operation, without disturbance of the ring. In my cases the time intervening between the two stages of operation has been ten to twelve hours.

The patients I have employed this plan upon are six in number. There has been no need of anæsthesia in the second operation. The opening of the abscess is done bluntly or by inserting a pair of forceps according to Hilton's plan. An interesting feature in them all is that the temperature and pulse have dropped to normal or nearly normal regardless of the quantity of pus present, although it amounted to about two quarts in the last case. Her temperature was 103.5° F at 8 p. m., when the incision was made; it was 99° F. at 8 o'clock the next morning when the abscess was opened and drained. Likewise after the first operation the few cases I have had have been more comfortable after incising the abdomen.

I fully recognize the fact that my cases, six in number, are too few to draw conclusions from, but they have been so satisfactory that this report is published for what it is worth. The principle is old, but I have not been able to find it recommended in this class of cases. In some cases it cannot be employed owing to inability to find a suitable point for doing the second operation after walling off. But it is conceivable that it might be servicable to any operator at some time, and highly probable that many might do well to follow it as a routine as nearly as possible. It converts a more dangerous lesion into a less dangerous one without additional risk to the patient.

AUTOGENOUS FASCIAL TRANSPLANTATION

With Report of Three Cases

By VICTOR F. MARSHALL, B. S., M. D., Appleton, Wisconsin
Surgeon, Saint Elizabeth Hospital, Appleton

CONCERNING the subject of autogenous fascial transplantation the report of the three following cases is quite apropos.

Case 1. Mr. J., janitor, age 42, November 23, 1913. Referred by Dr. Hunt. Was admitted to St. Elizabeth Hospital at 9 P. M. on account of gunshot injury to the left hand. In the afternoon while out hunting and in crossing over a log the gun was accidentally discharged. The entire posterior surface of the hand with the second row of carpal and first metacarpal bones were destroyed. The extensor tendons were destroyed. Hæmorrhage had been quite profuse but had now ceased. Under ether anæsthesia the wound was cleansed, the remaining fragments of the metacarpals and carpals removed and the tissue fragments trimmed. The tendons were united. The hand was materially shortened but this was deemed superior to an artificial hand. Suppuration occurred and the union of the tendons gave way. Upon cessation of suppuration and cicatrization of the wound, effort was again made to unite the severed tendons. Accordingly, on January 21, 1914, the second operation was carried out. Through a crucial incision with reflection of skin flaps, and after some effort, the ends of the severed tendons were found and union again accomplished. The annular ligament was quite wholly destroyed. To cover over this defect and to cover the tendons to protect the tendons and prevent adhesions to the incision, a fat and fascial graft from the right thigh was taken. The graft measured two by three inches and was sutured over the tendons and annular ligament. Uneventful convalescence and union followed with restoration of function.

Case 2. Miss M. V., age 32, January 23, 1914, entered St. Elizabeth Hospital for the removal of a tumor involving the external suprapubic region, and also for a fibroid of the uterus. The tumor involved the ventral wall and was slightly to the left of the old scar of a previous laparotomy eight years before for a left ovarian cyst. Under ether anæsthesia the tumor simulating a fibroma was removed from the abdominal wall. The muscles were not involved in the growth. An area two by three inches of fascial wall was removed. A supravaginal hysterectomy was done. To close up the large defect in the abdominal wall a fat and fascial graft three by four inches was taken from the left thigh and transplanted. Healing occurred by primary intention and convalescence was uneventful.

Case 3. Mr. L., blacksmith, age 51; large, corpulent man. Entered St. Elizabeth Hospital February 9, 1914, for herniotomy for large hernia of the left inguinal region. The hernia proved to be a large sliding hernia of the sigmoid. The sigmoid was freed and a flap of peritoneum incised on either side and sutured posteriorly and the viscus returned to the abdominal cavity. A Bassini repair was now made of the hernial opening. It was impossible to close the external ring owing to sparsity of fascial tissue — the defect being an area of two and a half by two and a half inches. A fat and fascial graft was now taken from the patient's right thigh and sutured over the defect. Healing occurred by primary union and convalescence was uneventful.

DEMONSTRATION OF A UNIVERSAL EXTENSION APPARATUS APPLIED TO A SURGICAL BED[1]

By CARL G. SWENSON, M. D., Chicago
Attending Surgeon Passavant Hospital

FOR convenience and durability a metallic footplate was devised and made. This plate has four bars and a loop-piece. The loop-piece is for the attachment of the pulley cord and the bars for the attachment of adhesive plaster strips. These strips, one by twelve inches in size, being doubled, are to be applied in a loop form around two of the bars and the bars are to be selected according to the width of the extremity.

In fastening the plate to an extension, for example, of the lower extremity the loop strips around the bars are simply fastened by safety pins to the ends of the adhesive plaster strips which have been previously applied to the leg. The lower ends of the adhesive strips applied to the leg should be doubled upon themselves to a point just above the ankle.

A desired number of pound weights are then placed on the smaller rod and this rod is connected in suspension by a cord to the footplate.

The advantage of this extension apparatus is that it may be conveniently and quickly applied to a bed and patient securely. Furthermore it is positively self-adjustable and universal in its applicability to the various forms of wood and metal bed frames in use.

It is believed that every one will agree that the

[1] Read before Chicago Surgical Society, April 3, 1914.

numerous extension apparatus hitherto used have been very deficient in their construction and inconvenient in their appliance. We have experienced the greatest difficulty with the various clamps in their adjustment into a fixed position to the bed frame rail. From the difficult adjustment of the different clamps to a bed, it occurred to me that we were in need of a universal clamp which could be easily and securely fastened to a bed. This idea has been carried our in a new invention, which it is hoped will be approved and found useful by all surgeons.

This apparatus consists of a universal clamp, a round rod with a pulley at its top, a smaller rod for the weights (the weights being a pound each), and a footplate.

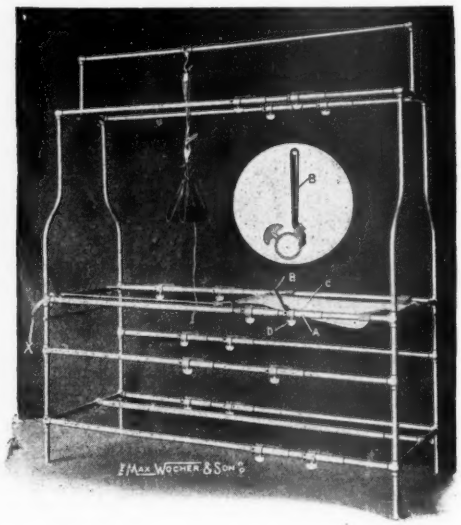
The clamp is composed of a fixed and a movable jaw and a thumbscrew. In fastening and adjusting the clamp to a bed its thumbscrew is first unscrewed, then the movable jaw is pushed apart far enough from the fixed jaw to make the space between the jaws sufficiently large for the clamp to grasp the bed frame rail. The clamp is then applied to the rail, its fixed jaw to be placed anterior and inferior to the rail and the movable jaw posterior to it. Into the opening and groove of the movable jaw and in the space between it and the rail the pulley rod is inserted and adjusted into any position desired, then the thumbscrew is screwed on the movable jaw tight enough to fix the rod, clamp and rail together securely.

The pulley rod, being composed of an "S" shaped round rod, a scored pulley, surrounded by a flange and a small thumbscrew, is universally adjustable.

A MODIFICATION OF ABBOTT'S FRAME FOR APPLYING SCOLIOSIS JACKETS

By ALBERT H. FREIBERG, M. D., F. A. C. S., Cincinnati, Ohio

IN using Abbott's frame for the application of scoliosis jackets the writer has several times found it disadvantageous that the three cleats on each horizontal rod could not be revolved independently of one another. This is due to the fact that in working the ratchet which



is found on each horizontal member of the apparatus, the tube to which all three cleats are screwed fast, revolves. There are eight such revolving horizontal members, each one having a ratchet mechanism similar to that indicated by X, in the illustration. The reduplication of this ratchet mechanism, furthermore, adds very greatly to the expense of the apparatus.

In order to obviate the disadvantage above mentioned and, at the same time, promote simplicity in construction, the writer has had a frame constructed which has been thoroughly tested by use and found entirely satisfactory. It is also worth mentioning that this construction reduces the cost of the apparatus to a considerable extent.

Instead of the cleats being fastened by thumb screws to a tube which revolves in its whole length always, they are attached to sleeves eight inches long (a), which are turned out of heavy walled steel tubing. At the thick end of each sleeve a number of holes are bored, by means of which a "spanner wrench" (b) may be engaged. The correcting band having been wound around the sleeve at (a) and caught in the cleat (c), the wrench is used to secure the desired tension which is then held by tightening the thumb screw (d). No difficulty will be encountered in securing any degree of tension in the correcting bands. It has not been found necessary to have more than two revolving sleeves on each horizontal bar. Within the circle, in the illustration, there may be seen an enlarged view of the wrench engaged in the sleeve.

In using this frame, the writer has found it very convenient to have a mirror placed on the floor, below the patient. By this means it is possible to view the under (or posterior) side of the jacket as it is being made and without having to stoop.

By having the uppermost horizontal bar (e) placed two inches higher than on Abbott's frame, this may also be used for the application of plaster jackets in vertical suspension.

SLIDING SPLINT OF PLASTER OF PARIS FOR FRACTURED FEMUR

By JAMES T. HANAN, M. D., Montclair, New Jersey

As far as I have been able to ascertain, the splint about to be described is a new departure in the apparatus treatment of recent fractures of the thigh.

I have used it now for over a year, in seven cases, applied to children and adults of weak and strong musculatures.

The splint is easy to make provided one is familiar with plaster of Paris; it takes about thirty minutes to complete, and keeps in good condition for six or eight weeks.

Reduced to the simplest form of description, it consists of a plaster cast of the leg and one of the thigh to which is attached a board slide with side extensions about three inches long and two and a half inches wide to overcome rotation of the leg; this entire board is thoroughly greased with vaseline before being attached behind to the thigh and leg splints by eight or ten turns of a plaster bandage and is therefore *free to move within its casing;* a sliding effect is thus obtained that allows for such traction upon the lower fragment as may be desired and consequent extension of this part.

The points of interest connected with it are: An accurately fitted splint to the contour of each limb treated, traction and extension in a direct line from hip to foot, prevention of rotation of the extremity, a constant flexed position of the foot overcoming any tendency to equinus, the avoidance of leg bandages and thigh coaptation splints, the easy and quick exposure of the entire leg and thigh for dressings or inspection, and its cheapness and simplicity,—a total cost of about three dollars being a maximum.

Application (under surgical anæsthesia):

1. The limb is cleansed with soap and water; shaved if unduly hairy, and washed with ether and alcohol.

2. The usual moleskin traction straps for Buck's extension are applied and the lower ends folded under the arch of the foot.

3. Moderately strong extension, to reduce the deformity, is made by an assistant holding the foot at a right angle.

4. Sheet wadding in rolls or a flannel bandage is snugly applied from the foot to the knee and from just above the knee to the groin.

5. A Gigli saw is placed on each side of the leg and thigh, kept in place by a bit of adhesive plaster and later used to split the casts into anterior and posterior splints.

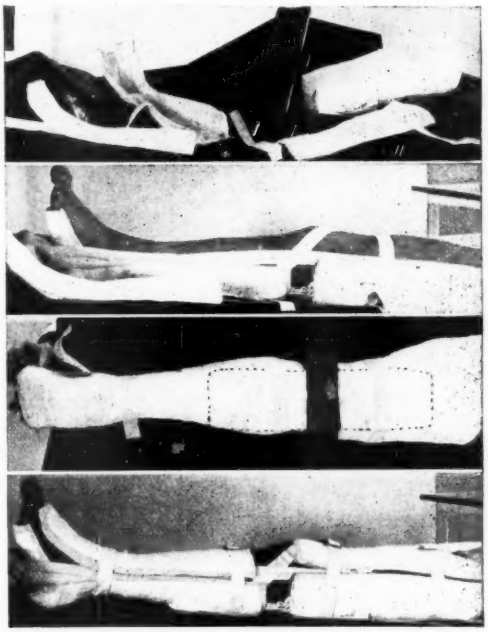


Fig. 1. Shows the completed cast disunited and the upper and lower anterior and posterior splints formed. In the posterior leg splint is seen the lower opening X in which the board-piece slides. Also in the center is the wooden key-piece, made of whitewood or pine, or, what is preferable, oak or ash; in length long enough to reach from the middle of the calf to the middle of the thigh (in adults from fourteen to fifteen inches), in width three and one-half inches and one-fourth to five-sixteenths of an inch thick; the side struts to further extend laterally three inches and have a length of about two and one-half inches. The straps of one inch webbing with buckles attached complete the picture.

Fig. 2. The apparatus completed but showing the upper splints removed for inspection or dressings.

Fig. 3. The wooden slide *in situ* with the dotted lines indicating its extent in plaster of Paris.

Fig. 4. The completed cast; splints in place, bound with adhesive plaster, and held in place by the straps of webbing; padding placed in popliteal space to support the knee and extension in force. A bandage ring under the heel and the sand bags have been omitted to facilitate a clearer view of the splint.

6. Three or four three-and-a-half or four inch plaster bandages are successively and snugly applied to the foot and leg as high as the tuberosity of the tibia and the same number from

above the knee to the gluteal fold. (Up to this point the technique is that of ordinary plaster casts of the thigh and leg, with the exception of placing the Gigli saws for cutting purposes.)

7. The well vaselined wooden slide is now applied posteriorly with the struts or side extensions midway between the upper and lower casts and fixed firmly in position by turns of a plaster bandage above and below the knee.

8. In about ten minutes after their application the casts are split by the Gigli saws into anterior and posterior splints and the separation continued from the malleoli forward to the sides of the toes by a sharp knife.

9. The top of the leg splint is now lifted off, and the traction straps, which have been folded under the arch of the foot during application of the leg cast, are pulled out and made fast to the weight of an ordinary Buck's extension.

10. Two straps of webbing are drawn about each splint to retain it in position.

11. Sand bags are placed on the outer and inner sides of the extremity to steady it and make pressure on the lateral struts, and the apparatus is complete.

At a later date the splints may be bound with adhesive plaster to give a finish.

As the swollen thigh shrinks, fresh layers of sheet wadding or cotton are placed beneath the anterior upper splint.

Two or three of the wooden slides, for adults and children, are kept on hand and the only other things necessary for the apparatus are the Gigli saws, moleskin or adhesive plaster, and the bandages.

The casts may be cut with a knife instead of the wire saws, but it is a much more laborious procedure.

In my first casts I used for the wooden slides a number of ordinary basswood coaptation splints, so that the more finished article is not imperative but makes a much more rigid splint.

With the cases in which it has been used there has been less than an inch of shortening; in several, none at all, and in others, three quarters of an inch or less.

Up to the present time there have been no instances of non-union and the series comprises individuals from the young to beyond middle age.

DILATATION OF AN OTHERWISE IMPASSABLE STRICTURE BY THE RETROGRADE PASSAGE OF A FILIFORM GUIDE

By A. J. UNDERHILL, M. D., Baltimore

THE procedure herein described was used on a patient on whom it was impossible to do a more radical operation under general anæsthesia because of his general physical condition. He was referred to me by Dr. Brent who was called in an emergency to relieve a complete retention of urine, which came on during convalescence from a severe attack of pneumonia complicated by a bad heart lesion. The right lung was still consolidated.

The patient had a stricture of the urethra at the bulbomembranous junction which had troubled him at intervals for the past fifteen years and finally at the time I saw him had resulted in complete retention of urine. After an unsuccessful attempt to pass a catheter or a filiform bougie it was necessary to aspirate his bladder. Morphine hypodermatically, warm sitz baths, and other measures were used to enable him to pass his urine voluntarily but without success. A second attempt to pass a filiform the next morning and a third one a few days later also proving unsuccessful, the patient finally consented to enter a hospital. His family physician had been relieving him by aspirating his bladder in the meantime.

The patient entered the University Hospital, December 20, 1913; a suprapubic opening was made in the bladder under local novocaine anæsthesia, and a drainage tube inserted. On the second day following the operation he had an attack of nausea and vomiting which lasted almost without intermission for three days. Temperature during this period ranged around 97 degrees; pulse 100. Intravenous phenolsulphonephthalein test at the time (done by passing a small soft rubber catheter through the drainage tube and withdrawing the urine with a syringe after first washing out the bladder) gave eighteen per cent in the first half-hour; time of appearance, ten minutes. An examination of the blood for the urea content showed gm. 1.25 to 1,000 ccm., demonstrating that the above attack was probably uræmic in origin. As a perineal operation under these conditions was inadvisable I adopted the following procedure.

A metal catheter was cut off below the eyelet and the shaft shortened until the instrument including the curve was 18 ccm. in length; the curve remaining was straightened to about 160 degrees. A filiform guide was obtained which at one end had a male thread cut to the same dimensions as the thread on the end of my Le Fort followers. This thread fitted of course the female thread in the ends of the filiform guides which were adapted to the followers.

The patient was placed on the table, the drainage tube

removed from the bladder, and the metal catheter, altered as above described, passed into the opening left by the removal of the tube. A Nitze observation cystoscope was inserted in the same opening between the catheter and the umbilicus, and while an assistant kept the bladder distended with a continuous stream of sterile water through a nozzle placed at the suprapubic opening, the interior of the bladder could be examined with ease through the cystoscope and the urethral orifice to the bladder located. Holding the cystoscope by the fingers of the left hand the end of the catheter was placed at this opening; both instruments were then grasped in the same hand and the two filiform guides, joined end to end, were threaded through the altered catheter, thus used both as a director and as a means of preventing the kinking of the flexible guides. The two instruments joined as described were pushed into the prostatic urethra and through the opening of the stricture with but little resistance until the small end of the first guide appeared at the meatus. This was grasped and drawn through, pulling the second one with it. When the joined ends of the two guides appeared at the meatus the first one was detached, replaced by a No. 12 Le Fort follower, which in turn was passed back through the stricture. This guide was then tied in the urethra for forty-eight hours, until after a subsequent dilatation with a larger follower when it was removed. Dilatation was then continued at intervals, as is usual in such cases, until the normal caliber of the urethra was restored.

The anterior aspect of these strictures is often mutilated and distorted by previous attempts to pass instruments with the result that the passage of filiforms by the ordinary route is rendered impossible because of tags, false passages, blood-clots, etc., which destroy the more or less funnel-shaped orifice to the strictured canal. The cul-de-sac formed by the bulb, if not completely obliterated by the scar tissue, adds to the difficulty of entering a filiform at this point. The instrument in its retrograde passage in the case described followed a virgin route and passed without difficulty, the posterior entrance to the stricture probably forming a funnel which guided the instrument into the narrowed lumen of the urethra.

While an external urethrotomy under ordinary circumstances is the more desirable operation in dealing with impassable strictures in this region, the above method may be a good substitute in instances where the patient's condition will not admit of a general anæsthesia with the sometimes long and tedious manipulations required in doing this operation without the aid of a guide.

TRANSACTIONS OF SOCIETIES

CHICAGO SURGICAL SOCIETY

A Regular Meeting was Held April 3d, 1914, with the President, Dr. M. L. Harris, in the Chair

SARCOMA OF THE HUMERUS — BONE TRANSPLANT

Dr. Albert E. Halstead: I wish to report a case of sarcoma of the upper end of the humerus.

The patient, 17 years of age, was operated on in July, 1913. The history of her trouble dates from April, 1913. Following a kick from a horse, pain, swelling, and loss of function called attention to a growth in the upper end of the left humerus, which upon examination proved to be a medullary sarcoma.

The upper half of the humerus was resected and a bone-graft from the tibia implanted. The union between the graft and the remaining portion of the shaft was accompanied by reaming out the medullary cavity of the upper end of the shaft and driving the end of the graft into the medullary cavity of the fragment of the humerus reaming after resection of the upper half. The graft was covered on two sides by periosteum. This at the lower end of the graft was united to the reflected periosteum of the remaining portion of the humerus.

The first radiogram was taken about two weeks after the operation; the original cast was still on. This shows the graft alive and no evidence of absorption present. You will notice one point where the graft is rather thin, but it is beginning to thicken, it has become round, and the union between the two fragments is evident.

The next radiogram was taken six weeks after operation, the girl having gone home, and returned for examination. You see how much thicker the graft is and how it has grown. The other radiograms were taken at intervals of about six weeks; the last one in January, 1914. This shows that the union is complete. The graft is practically the same size as opposite the humerus. There is free mobility of the joint, although abduction farther than a right angle is impossible. There is no pain or disability in any way except limitation of motion so far as abduction is concerned.

This case demonstrates that a graft, when nutrition is adequate, thrives from the first and does not undergo absorption. At no time was there any evidence of rarefaction or disintegration of the graft. The bone remained virile and gradually grew until the thickness of the graft equaled that of a normal humerus.

In a second case in which grafting was done, the first graft made to replace the lower end of the radius was entirely absorbed. The radiogram showed gradual disintegration of the bone until finally only a thin, white, silvery strip, indicating the periosteal covering on the graft, remained. From this, gradually developed new bone until the graft reached the thickness of about five-eighths of an inch. In this case it was evident that the nutrition was not sufficient to maintain the vitality of the graft and that absorption followed, the regeneration taking place in the osteoblasts in connection with the lower layer of the periosteum. In the same case subsequent grafting of the lower end of the ulna was resorted to. In this the graft remained intact and grew from the first. In both instances the graft was taken from the tibia and was covered on two sides with periosteum and on the third side medullary tissue formed part of the graft. These two cases bear out the contention of McWilliams of New York that the vitality and subsequent growth of the bone-graft depends upon its nutrition, and that the osteoblasts in a bone-graft depend upon its nutrition, and that the osteoblasts in a bone-graft proliferate, and from these new bone is developed, and that although bone does not originate from periosteum, yet the presence of periosteum on a graft makes the subsequent life of the graft more certain by assuring a quicker blood supply to the graft or by maintaining the vitality of the osteoblasts until the adequate blood supply is established.

Dr. Carl G. Swenson demonstrated a universal extension apparatus applied to a surgical bed. (See p. 114.)

Dr. Coleman G. Buford read a paper entitled "Resection of the Tibial Diaphysis; Partial Regeneration; Tibial Transplantation," with exhibition of several radiograms.

Dr. Kellogg Speed read a paper entitled "Discussion of Pott's Fracture with Complications Based on 208 Cases." (See p. 73.)

DISCUSSION

Dr. D. N. Eisendrath: I think we are all indebted to Dr. Speed for his most painstaking study of these cases. Those who have had experience at the Cook County Hospital know

what a hopeless task it is to delve through the histories, and the system of filing X-rays, is unfortunately, very inadequate. I would plead for a change in our nomenclature and the manner of teaching students the definition of Pott's fracture. The definition of Pott's fracture as given originally by Pott is inadequate. It is just as inadequate as the term Colles' fracture at the present time. Since the X-ray is used systematically in all cases, especially in our largest cities, we now know the old term Colles' fracture applies only to a small portion of the fractures at the lower end of the radius or forearm. It is better in teaching students, especially when it comes to the use of the term Pott's fracture, to extend the term Pott's fracture as applying to that particular variety, but since we know them better we speak of them as fractures of the lower end of the bone or both bones of the leg.

I think we ought to standardize the histories of fractures more. There is an effort being made by the Committee on Hospitals to try to do this.

Within the last few months, or since the first of the year, I have attempted to make up X-ray tracings of every fracture or the number of other conditions which can be helped by X-ray tracings; that is, take a piece of ordinary tracing paper and pressing on a piece of paper and finally adding it with the history sheet. We ought to familiarize ourselves, without taking the trouble to look-up the X-ray, with the condition of the patient four weeks after fracture has occurred and when treatment was begun.

I have discarded the use of ordinary wooden splints or blanket splints except as a temporary measure, or all fracture boxes, and I want to emphasize one point, and that is, as soon as possible to anæsthetize the patient as soon as we have taken an X-ray and put him up in some sort of temporary dressing which will not allow of any displacement. I find for that purpose, especially for the hand and foot, a moulder of plaster of Paris splints is very useful. We have used it for many years at the County Hospital. The trouble with many fractures of this kind is, we put them up temporarily in a blanket splint and the displacement is not corrected as it ought to be, and when we come to anæsthetize the patient in a week or ten days a certain amount of callus has taken place and it is difficult to get a good anatomical result.

Dr. Speed neglected to call attention to two types of cases in which we have a good deal of trouble around the ankle-joint; one is the impacted fracture of the tibia or fibula, and the other is the spiral type. Several of his pictures show this beautifully. The upper end of the tibia is impacted into the lower end in such a way that correction becomes very difficult, and it is not until we actually get much freedom of motion at this point that we can hope to get any sort of results.

He laid emphasis upon a very important point, and that is not permitting patients with fractures of both malleoli, and with them laceration of the lateral ligaments, to step on the foot too early. That is a mistake we make frequently. When we allow a patient to step on the foot four weeks after the injury the result is that it is not as useful to the patient as it ought to be, and so he has great impairment of motion, and, what is more important, has a traumatic flat-foot. A great many of these cases have disability for months because we have neglected to think of not only fracture having taken place but laceration of the ligaments.

I was very glad to have him call attention to one point, and that is the importance of a wedge getting in there and preventing correct apposition and preventing good movement of the foot later on.

DR. SPEED (closing): My first interest was attracted to these cases by a number of instances of Pott's fracture that had come back to the hospital. After they are discharged, they are out a few weeks and acquire this flat-foot due to improper shoes and improper walking and insufficient hardening of the callus. If you will take a picture four or five or six weeks following a fracture, the bone seems to be firmly united and the callus is in good shape. Let a man go out and do laboring work and carry a heavy burden: you will find a loosening of the callus and deformity returning. That is the reason these patients should have prolonged immobilization until the callus has hardened and settled down and until the ligament is firmly united. The ligaments, as the pictures show, are extremely important in these cases when you consider the astragalus is swung and carried by the ligamentary structures far more than any bone.

Dr. B. D. Phemister presented specimens of "Retention Cyst of the Appendix."

RETENTION CYSTS OF THE APPENDIX WITH DEMONSTRATION OF THREE SPECIMENS

D. B. PHEMISTER: Chronic retention of secretion in the vermiform appendix producing a cyst-like hydropic swelling of the distal portion of the organ is of relatively rare occurrence. It results from a gradual narrowing of the lumen in the proximal portion of the organ, developing usually as a result of a mild attack of appen-

dicitis, but in many cases without any previous history of appendix trouble. Most of the cases have occurred after the thirty-fifth year. The process is closely associated with the normal involution of the appendix and appendicitis obliterans.

The changes in the wall at the seat of obstruction are variable. In most instances the lumen is obliterated, while in others only narrowing or angulation is present. The obstruction is usually located at the cæcal end, but it may be at any point along the course of the organ. Occasionally there is obliteration of the distal and proximal portions leading to a cystic dilatation of the middle portion. The dilatation may be of the appendix alone in which case either a spherical or a sausage-shaped swelling results. In some cases the dilated appendix is accompanied by a diverticulum while in others the entire swelling consists in one or more diverticula, the wall of the appendix elsewhere being sufficiently resistant as not to dilate. The changes in the wall of the dilated appendix vary according to the amount of distention. In the milder grades the various coats are retained but the mucous membrane is flattened out and the fibrous tissue of the wall is increased. In more marked cases the musculature disappears and the wall consists of fibrous tissue with a very thin mucous lining which is frequently calcified in many places. In extreme cases mucous membrane partly or wholly disappears.

The sac is usually filled with a thick mucous content which upon chemical analysis is found to consist chiefly of pseudomucin. These cases were formerly mistaken for colloid carcinomata of the appendix, a condition which subsequent observations have shown to be extremely rare.

Accidents which happen to a mucocele of the appendix are infection and perforation. Infection is rare and may bring on the symptoms of an acute appendicitis or convert the cyst into an empyema of the appendix. Perforation is fairly common but no acute symptoms of peritonitis result from it, as the contents are nearly always sterile. The perforation may remain open indefinitely, or after a time it may close. Masses of the mucous contents escape into the peritoneal cavity and produce one of two conditions. They may remain in the region of the appendix and become encapsulated and converted into cysts by the growth around them of a fibrous covering from peritoneum. In other instances where the secretion is extensive these masses become scattered throughout the general peritoneal cavity. They set up irritation and exudation, become attached and encapsulated and produce the condition known as pseudomyxoma peritonei. Sometimes epithelial cells are carried out with the pseudomucin and proliferate, producing a picture simulating implantation metastases in carcinoma, but the history of these cases subsequent to removal of the appendix or closure of the perforation is that they clear up and very seldom end in malignancy.

The three specimens to be shown illustrate three types of the condition: first, a large mucocele of the entire appendix; second, a mucocele with perforation and pseudomyxoma peritonei; and third, a diverticulum of the appendix. The first specimen is from a thirty-six-year-old woman operated on by Dr. Dean Lewis. She had noticed a swelling in the right lower quadrant of the abdomen for one year which had gradually increased in size. It produced no symptoms until three months before operation when she began having a dull ache in this region and some backache. There was never any severe pain and no history of a previous attack of appendicitis. Examination showed a cystic swelling in the right lower quadrant which was thought to be an ovarian cyst. At operation it proved to be from the appendix, and the genitalia were free from disease. The entire appendix was involved, the cyst being sausage-shaped, measuring 17 cm. in length and 21 cm. in its greatest circumference. The wall was everywhere thin and translucent, but in a few areas there were plaques from fibrous thickening. It was filled with a thick gelatinous material which after hardening did not escape from the small windows excised from the wall. Microscopically the wall consisted of fibrous tissue with a mucous covering in some areas but with calcification along the surface and complete absence of epithelium in others.

The second specimen is similar in structure to the first but somewhat smaller in size. It was removed in 1907 by Dr. O. T. Roberg from a woman forty-six years old who came because of a left inguinal hernia, the existence of the movable swelling low down on the right side not having been noticed. There was no history of previous appendix trouble. At operation the peritoneum was studded everywhere with gelatinous masses, large numbers of which were removed from the sac of the hernia and from the cul-de-sac of Douglas. The thin-walled cystic appendix was about 13 cm. long and 15 cm. in circumference. It was filled with a thick pseudomucinous material and a small perforation was present through which the gelatinous contents escaped into the peritoneal cavity. The case was thought to be one of colloid carcinoma of the appendix at the time, but after removal all

the symptoms disappeared and the patient is still living and well.

The third specimen from the museum of Rush Medical College is a diverticulum of the appendix about the size of asmall grapefruit which was removed from a woman forty-eight years old during an operation for ovarian cyst. It has been carefully studied and reported by Dr. Isabella Herb. The proximal portion of the appendix is obliterated but the organ is only slightly dilated. The diverticulum comes off from the region of the mesenteriolum and its wall is extremely thin, consisting entirely of fibrous tissue. It was filled with the same pseudomucinous material as was found in the other two cases.

FIBROMA OF THE APPENDIX

Dr. Samuel C. Plummer: I wish to show a specimen of fibroma of the appendix. It occurred in a young man who gave a history of recurrent attacks of appendicitis of mild degree. This mass could be palpated through the abdominal wall and naturally it was thought to be a concretion. It proved to be a fibroma, however, and was about the size of a hazel-nut.

Dr. Nelson M. Percy: This appendix I show you was removed in January of this year from a patient, 55 years of age, who gave a typical history of gall-stone trouble but not of appendicitis, although examination revealed tenderness over the region of the appendix. When the gall-stones were removed, an examination of the appendiceal region revealed this large cystic appendix. This cyst was nearly double the size it is now, being about five and one-half inches long and two and one-half inches at its greater diameter. It contained a gelatinous fluid and in the top of it was a hole through which leakage occurred.

About six months ago we encountered another case at St. Mary's Hospital which was about two-thirds as large as this one, but through a mistake of the interne the specimen was lost. Neither one of these patients gave a history of having had an attack of appendicitis.

Dr. Phemister (closing): There are several things that might be mentioned, one of them the association of cyst of the appendix with cyst of the ovary, which makes this condition of pseudomyxoma peritonei. The appendix has apparently become secondarily involved in quite a number of cases, and it is hard to say whether the appendix or the ovaries are the cause of the condition.

I would like to hear from some of the older men regarding the question of chronic empyema of the appendix and if they have seen any of those cases.

CHICAGO GYNECOLOGICAL SOCIETY

A Regular Meeting was Held March 20, 1914, with the President, Dr. Frank W. Lynch, in the Chair

ABDOMINAL PREGNANCY

Dr. Theodore J. Doederlein reported the following case:

Mrs. B., family history negative, had her last menstruation about the middle of April, 1911. She claims she observed nothing abnormal during her pregnancy and felt very active life up to one week before labor commenced. Typical, periodical pains started in the night before the twenty-third of January somewhat later than labor was expected. In the morning I was called in consultation by Dr. Germer, who had noticed regular pains and the unusual state of affairs during the time he was at the bedside.

I found the patient a well-built woman with normal pelvic diameters and enormously distended abdomen. On the left side the only covering over the fœtal parts seemed to be the thinned-out skin. On the right side a large boggy mass could be outlined. Vaginal examination yielded nothing but a short vagina, a large, undefinable mass presenting, and absence of cervix and os. On using much force the finger followed a recess high up toward the left parametrium. I concluded that for some reason the uterus had turned fundus downward, as is found in impactions in the cavity of the sacrum or after ventrofixations. The patient was removed to the German Hospital, the genitalia shaved and disinfected in the delivery room and another examination made under anæsthesia. I now could reach the small undilated cervix high up in the left vaginal fornix and with great difficulty succeeded in introducing my finger into the uterus and found it empty. It now was obvious that we had to deal with an abdominal pregnancy and the patient was taken to the operating room.

On opening the abdomen through a median incision we found a thin amnion on the left and a conglomerate mass of omentum, intestines and placenta on the right side. The placenta was large and thin, and adherent to the serous surfaces of intestines and parametrium. The sac was emptied of its contents consisting of two fully developed fœtuses and a large amount of fluid. Each fœtus weighed about six and one-half pounds. Believing that the danger from simple drainage of the sac would be as great as that of extirpation of the entire mass, including the uterus, I commenced below making a supravaginal amputation and dissecting upward. At first matters progressed rapidly but higher up the intestines were so intimately adherent that dissection was most

difficult and tedious. So it happened that an apparently innocent looking strand of peritoneal adhesions high up on the tumor upon cutting proved to contain a loop of intestine. A hurried end-to-end anastomosis was made and after the abdomen appeared clean I proceeded to peritonize very carefully. I believe that this saved the patient. Although there was a good deal of hæmorrhage and the patient's pulse was very high the first twenty-four hours, she really made an uninterrupted recovery and at present enjoys perfect health. Unfortunately the fœtuses were not allowed to remain with this unique pathological specimen.

MALIGNANT TUMORS OF THE OVARY

DR. EMIL RIES: Some time ago I demonstrated to the society a specimen that had been obtained from a patient of mine and, at the same time, discussed the question involved in the case, the origin of bilateral malignant tumors of the ovary, and referred to the limited number of cases reported in the literature which demonstrated fairly clearly that all of these cases, if carefully examined, proved to be metastatic, not primary. At the present time, whenever we find a bilateral malignant tumor of the ovary, our diagnosis is not complete unless we have excluded the presence of a malignant primary tumor either in the intestinal tract or in the gall-bladder.

The patient, whose specimen I wish to demonstrate to you, is a woman, fifty-seven years of age, who was sick for several months, with loss of flesh, some stomach disturbance, lack of appetite, and gradual swelling of the abdomen and legs. The abdomen became so filled with fluid that her physician tapped her some three weeks before she came under my observation and removed a considerable amount of fluid. The fluid was serosanguinolent and came in the quantity of nine quarts. After the tapping the physician was able to feel a tumor in the region of the umbilicus, although he was not sure of its nature. I did not see the patient until the fluid had reaccumulated, and the tumor which he had been able to make out in the region of the umbilicus was then not palpable, on account of the quantity of fluid which was again present. On vaginal examination I could feel two tumors, one on either side of the uterus, and diagnosed from their hardness, from the age of the patient, from the symptoms and from the fluid in the abdomen that they were malignant tumors of the ovary, and also made the diagnosis that they must be secondary to something else. As these tumors compressed the rectum, and as it was possible that I might be able to remove the metastatic tumors of the ovary, as well as the tumor of the intestinal tract, if such a one were present, I undertook the operation with the intention of removing both. On opening the abdomen we had the escape of a considerable amount of fluid again. I then immediately saw the tumor which the doctor had palpated in the region of the umbilicus. It was a tumor of the omentum. The whole omentum was changed into a boardlike mass, so that there was no healthy omentum to be seen. This mass was attached to the transverse colon and kept the transverse colon perfectly rigid. In the pelvis were the two ovarian tumors as diagnosed. The small intestine showed no tumors. The gall-bladder was free. On the lesser curvature of the stomach, attached to the liver by adhesions, was a hard tumor, nodular, evidently malignant. In the presence of the tumor of the omentum it was clearly out of the question to do a radical operation. It was a question whether it was wise to leave the ovarian tumors alone, but as the tumors had developed between the uterus and rectum and compressed the rectum, I considered it wise to remove the ovarian tumors to give the patient a chance to have regular action of the bowels. I did that particularly because in a similar case some years ago, in which we found the ovarian tumors inoperable, the woman ultimately died from complete compression of the rectum with ileus. In this case I removed the two ovarian tumors without any difficulty and the woman so far has made an easy recovery. The fluid is already reaccumulating.

Microscopic examination of the tumors removed shows that they are distinctly of a type which does not belong to the ovary. They are distinctly adenocarcinomatous, such as we would expect to find in the stomach or intestine; the cells showed a secretion of mucus as in adenocarcinoma of the stomach or intestine.

The case is interesting as confirming again the fact that these bilateral malignant tumors of the ovary are practically always secondary to some primary tumor in another location, and that it is not sufficient to try and remove these tumors, but we should try to remove the primary tumor also, if it is possible to do so. Amann, of Munich, was able to do resection of the stomach in one case of removal of metastatic ovarian tumors, but it is not known how long the patient was free from recurrence after the operation. The chances of such patients remaining free from recurrence for a long time are not excellent.

PROLIFERATING CYST—ADENOMATA OF THE OVARY

DR. JOSEPH L. BAER: I might briefly report a case which parallels the one related by Dr. Ries, and which I have had the unfortunate privilege of observing for about eight years in a relative of mine, who was operated upon by Dr. Henry Banga eight years ago. At that time he found bilateral ovarian tumors which were diagnosed microscopically by Dr. Herzog as proliferating cyst-adenomata of the ovary. Nodules were already studding the peritoneum. There were half a dozen of these, and Dr. Banga excised each of them, found nothing else, but did not explore the upper abdominal cavity. That was eight years ago. The patient made an uneventful recovery and for four years had no symptoms; then she began to have vague abdominal pain, and three years ago developed acute intestinal obstruction, for which she was laparotomized by Dr. Greensfelder, and the entire abdomen was found to be a mass of carcinomatous metastases. The omentum was identical with that which Dr. Ries speaks of; namely, a boardlike infiltration, which was at least two inches thick and overlay all the rest of the abdominal contents. There were isolated nodules throughout the bowel; the bowel was involved, and in order to overcome the obstruction Dr. Greensfelder found only two areas of bowel that were uninvolved, and without knowing the exact anatomy of the two made an anastomosis. Fortunately, it served as a short-circuit. The patient recovered and is still living, but is emaciated to a skeleton,

and undoubtedly in the next month to come will succumb. At the time of her second operation a thorough exploration was made, or as thorough as all the metastases and adhesions would permit. The gall-bladder was found filled with uncounted stones, but the condition of the patient being as it was, the gall-bladder was left untouched.

There was no conclusion reached as to the primary origin of the tumor, but an examination of a piece of this enormously infiltrated omentum revealed adenocarcinoma of this type. This case, therefore, falls in the category mentioned by Dr. Ries.

TUBAL ABORTION

DR. EMIL RIES: I wish to report another case because the treatment is somewhat unusual and may give rise to criticism and discussion, which I welcome most heartily.

A young woman, twenty-four years of age, who had never been pregnant, came to the hospital complaining of hæmorrhage which had been going on for three weeks. She had never missed menstruation and had always been regular. She had pain in the left side of the abdomen extending through the pelvis and into the perineum. These pains were sharp and colicky, but she had neither fever nor chills. She had some general malaise and weakness. Bowel movements were regular. There were no urinary symptoms, and no respiratory or gastro-intestinal symptoms. On examination of the otherwise healthy, strong-looking young woman, we found the uterus anteverted, and beside it a little mass attached to the right side and anterior surface of the uterus which felt as hard as a fibroid. I could not tell exactly whether it was a fibroid or adherent mass of appendages. As she had never had any children there was a chance of there being old infected and adherent appendages there. We did a laparotomy. The moment we opened the abdomen we saw free blood in the peritoneal cavity; the uterus and the bladder were agglutinated by adhesions which held the bladder to the fundus of the uterus. The left appendages were tied down by adhesions. The left tube was closed at its end; the right tube appeared a little thicker than normal, rather pink, and as I picked up the abdominal end of the tube a tubal mole dropped out of the fimbriated end of the tube. I saw an actual tubal abortion take place under our eyes.

The question arose, When this woman had aborted from the tube, is it proper treatment to remove the tube which is getting over the pregnancy so that this young woman, whose left tube is useless, will never have a chance to have a baby, or is it better to let that tube go through the puerperium the same as a uterus would after abortion and recover as far as possible, so that the woman may have a child hereafter? Of course, the question was largely one of danger of hæmorrhage from that tube. We know that the danger of hæmorrhage from a tubal mole, once it has been expelled, is not great. I watched the tube a little, while taking out the appendix and investigating the gall-bladder, and going back to the tube to see what it was doing. It was oozing very little. The fimbriated end seemed natural and patulous, and I decided to leave the tube. So far, she has made a good recovery. She had a little temperature when she came in, and she has a little temperature now. We know that these cases of extra-uterine pregnancy frequently have a temperature of 99° or 100° and that does not amount to anything except that there is blood in the abdominal cavity. Her highest temperature was 100.8° per rectum; pulse 84. There were never any disquieting symptoms of internal hæmorrhage. So far, I should consider the woman's condition perfectly safe. She lies in bed smiling and has no special complaint. The first two days she was uncomfortable but has now made a good recovery.

I should like to have your opinion whether it is a good thing to leave such a tube with the chance of another extra-uterine pregnancy and also a chance of normal pregnancy, or whether it would have been wiser to have taken out that tube to prevent further trouble.

I have a specimen showing chorionic villi, so that there is no question about the pregnancy.

STUDIES OF THE LYMPHATICS

DR. DANIEL N. EISENDRATH: Before showing you some kidney specimens, it might be of some interest to speak of the work we have been doing on the lymphatics. We have been studying the lymphatics of the ureter. My assistant, Miss Burn, has been injecting the lymphatics of the intestine and lymphatics of the anterior wall of the stomach, especially those near the pylorus ending in the glands, and the technique that was used is that which is the most popular to-day; namely, the Gerotta method of injecting a solution of Prussian blue. In connection with work on the kidney the operation of nephrotomy has been almost superceded by pyelotomy and taking out the stone from the posterior aspect through the pelvis of the kidney. In the early stages of development of that operation it was not considered necessary to remember that there was more than one type of pelvis, and that was the one we have been taught in our anatomies, that the kidney simply had practically one type, namely, the ampullar type, which consisted of a large ampulla from which the various calices came off, the primary and secondary calices. As the operations continued to develop in number it was found there were other types of pelves which were considered, and these have been the subject of considerable study.

We will have studied, this summer, about 200 pairs of kidneys and our results so far show that about 80 per cent of the kidneys contain the type of pelvis which is known as the ampullar type seen in this specimen; that about 15 per cent contain the type of pelvis in which the ureter divides almost immediately without a pelvis proper into what is known as bifid, and a third type where the ureter divides almost immediately into three. I have no specimen illustrating the third type, but we have beautiful examples of some dissections which were made of the different types, and also specimens showing the anatomy of pyelotomy.

COLLARGOL INJECTIONS

Dr. Ries has asked me to present to you briefly the work we have been doing on the in-

jection of collargol. As you know, collargol was first suggested by Welcher in 1906, injecting it through the ureter up into the pelvis of the kidney, taking an X-ray and thus getting an outline of the pelvis of the kidney. The method has been gradually discredited, and unjustly so, owing to the number of deaths that have occurred or the ill results following the injection. There has been sudden death within five or ten minutes or an hour after the injection in several instances, especially in the cases of Smith, of Cincinnati, and even in others where the patients did not die until about a week later. It has been difficult to explain a number of these cases. Several experimenters have tried by injecting collargol directly into the ureter to study its effect upon the kidney, and they have found in certain conditions there would be a typical wedge-shaped infarct produced in the kidney which a number of my specimens will show. Unfortunately no one took into consideration in any of the experimental work the question of the relation of the amount of collargol which was injected to the pressure, and at the suggestion of one of my friends, Dr. Greensfelder, we began our work of simply injecting the collargol without any effort to study the effects of pressure, and we obtained typical collargol infarcts, as you will see from the specimens which I pass round, which have their bases toward the cortex and apex towards the papilla and which in some cases goes on to necrosis. That is the serious consequence.

The first specimens which I shall pass around are those where we injected kidneys without any effort to study the amount of pressure. We soon found that it was impossible to deduce any conclusions from such an irregular study, so that we began to use a manometer, and we are doing that work still. First of all, we estimated exactly the capacity of a dog's kidney, which is 2½ ccm. The moment you inject more than 2½ ccm., which will run under a pressure of 35 mm. of mercury, which is equal to 3 feet elevation above a table, you begin to get trouble because one of two things happens: either the collargol will escape into the peripelvic tissue, as happens frequently; it cannot force its way beyond the pelvis of the kidney, but forces its way either into the peripelvic or perirenal tissue, as these specimens show; or the more serious consequences happen, namely, we understand why these people die after the injection of collargol. We find that as soon as we exceed by quantity, say of 4 mm., which will more than comfortably distend the pelvis of the kidney, the moment we exceed under pressure 80 to 90 mm. of mercury, trouble begins. In other words, if the collargol does not escape into the perirenal tissue, the other dire consequence happens—it gets into the circulation, forces its way into the interstitial connective tissue, and gets into the renal vein. In the specimen I pass around, the dog died within five minutes after we injected 20 ccm. of collargol under 100 mm. of pressure into its right kidney. It was not an anæsthetic death, because there was little anæsthesia given during the operation. The moment the dog died an autopsy was done. We found the vena cava filled with collargol. We found the right side of the heart filled with collargol, and you will see in this specimen that the right side of the heart is tremendously filled with collargol, the left side less so.

Here is a beautiful example of collargol embolism. If you take these two lungs, one of which represents the milder stage—one of the animals died in about thirty minutes after the injection of collargol,—you will see black spots showing the milder degree of collargol embolism. In the next specimen the entire lung is perfectly black with collargol, and from the microscopic specimens every little capillary of the lung is filled with collargol. We obtained the same results not only by the collargol in the lungs, but collargol infarcts in the liver corresponding with the infarcts described by Rest as found in his specimens. There were collargol infarcts both in the liver and spleen. This specimen shows beautifully collargol in the veins of the liver. You can do no harm by these injections as long as you do not exceed a reasonable degree of pressure and do not exceed the capacity of the renal pelvis. In other words, in order to do safe pyelography, we dare not use any force. As long as we do not use too much force and too large a quantity of collargol, we will not have trouble, but the moment we exceed that we will.

Dr. Emil Ries read a paper entitled "Diagnosis of Tumors of the Breast during Operation," which was illustrated by numerous stereopticon slides.

DISCUSSION

Dr. Channing W. Barrett: Those who have had the opportunity of listening to the paper of Dr. Ries and witnessing the demonstrations feel well repaid for being here. He has covered the ground on the question of whether a tumor is benign or malignant so well that there is very little left to be said. I feel there is no part of one's work that is more satisfactory in the outcome than a microscopic decision at the time of operation upon a tumor, whether it is benign or

malignant—not that there is never a mistake, but if we can decide at the time of the operation that the tumor is benign and save the breast, take out the tumor, or save the muscles, or if we can decide that the tumor which seems possibly benign is malignant and judge of the early radical operation, we have done a splendid thing for the patient. We have had cases both ways that we thought from an examination of the breast the tumor was malignant, have told the patient that in all probability the breast would have to be amputated, and we would take this means of finding out, and find upon examination it was a perfectly benign tumor and vice versa. I have never yet had it happen after deciding that a tumor was benign and had removed the tumor and left the breast, that on further study of the tumor it was malignant. I recall one case not many months ago in which the pathologist came to the conclusion that he could not state whether the tumor was benign or malignant. He said that while he could find no areas that were distinctly malignant, yet he was very suspicious in the tissue he had at his disposal there was beginning to be a change into malignancy. In that case, when we cut into the growth, which lacked definite limitations or borders, I decided clinically that it ought to come out, and further study of this tumor proved it to be malignant. The glands in the axilla were involved.

Those who know Dr. Ries respect his judgment in pathology, but I must say I would remove some of these breasts upon less suspicion than is shown in some of the slides.

I recall one case we operated upon in which the woman had had her breast removed on the other side—the right side. Then a tumor developed in the left breast which was movable. Clinically from the feel of the tumor it seemed benign, but from the standpoint of having the breast removed on the other side we were suspicious of its being malignant. Microscopic examination of the tumor we removed showed it to be a fibroma intracanaliculaire, as shown here. It was a typical specimen, and the breast was left, greatly to the satisfaction of the patient.

While the radical removal of a breast is not an operation that has any considerable mortality, there are reasons why a patient does not like to have a radical operation. There are physical reasons why a patient is not so good an individual afterwards because a radical operation means the removal of muscles that make the arm less useful for manual labor, but that is no reason why a carcinoma should not be removed.

We see in the literature statements to the effect that the tumor should be watched carefully to see whether it develops elements of malignancy. There is such a tendency for breast tumors to become malignant that that form of treatment of watching and waiting is unjustifiable in the presence of a tumor of the breast. We do not wait for them to develop malignancy. We want to get at the tumor before it becomes malignant, if possible; and this method gives us an opportunity to get hold of the tumor without waiting to see if it is going to develop malignancy, and yet not remove useful structures, and we believe it is a great improvement to the waiting and watching treatment of these cases.

Dr. Jones: In the last year or two I have noticed that not only in epithelial tumors of the breast, but also in papillomata of the bladder and in papillary cystadenomata of the ovary, where we have anywhere a hollow gland, with epithelium proliferating into the gland, it seems to be the first stage of malignancy. Genito-urinary specialists, who formerly looked upon papilloma of the bladder as benign simply because the epithelium did not penetrate the basement membrane, are now looking upon such a tumor as malignant because ultimately these tumors do become malignant, and it seems to me the sections shown here to-night with the epithelium filling up these glands were rather suspicious, to say the least.

Dr. Emil Ries (closing): In answer to the last point raised about these adenomas, I will say they are the most difficult to classify strictly one way or the other, because they are the ones most frequently associated with distinct malignant changes. There are several papers concerned with that particular diagnosis, one from von Eiselberg's clinic which gives most beautiful pictures that might be considered copies of these sections; but they came to the conclusion that as long as the wall is not involved we have no right to call them malignant.

One of the specimens I showed you is from a young woman on whom I operated twelve years ago. She came to me because of the discharge of blood from her nipple, which greatly annoyed her, because it came through her dress and showed on the outside. I removed only the breast. I saw her a few months ago and she was perfectly well. There is no sign of recurrence.

I showed you another specimen where the papillomatous mass filled the milk-channels. This woman was operated five or six years ago and is free from recurrence. I have shown you a case where the woman had a carcinoma of the uterus, the uterus was removed, and she is free

from recurrence. But these adenomata and papillary adenomata occur so often in the presence of carcinoma that I am extremely careful to go through such a breast very thoroughly before I assume there is nothing but adenoma. These are the hardest cases to diagnose, because they may require hundreds of sections, and who has the time to make hundreds of sections from the material of such a suspicious breast when the patient is on the operating table? I am inclined to think that in a case like this, the breast I have removed, which is possibly carcinomatous, is not a great loss. On the other hand, if I should leave a breast that is carcinomatous, that patient is bound to have further trouble. We have to use our clinical knowledge and gross pathology just as much as the microscope. The microscope is only one of the aids.

I really have nothing to add in this company, although if I were addressing a different audience I should urge most earnestly what Dr. Barrett said about the policy of waiting and seeing what will come. I have seen that altogether too frequently, as most of you have. I remember particularly the case of a woman, the mother-in-law of a physician, who had a small tumor in her breast when she was sixty years of age. He asked her if it hurt and she said no. He then said, "Let it alone," — and at the end of four months her breast was one mass of tumor. The glands in the axilla and above the clavicle were enlarged. The tumor was adherent to the underlying surface and adherent to the skin to such an extent that perforation was imminent. I told the woman I could not cure her; that I would merely take off the breast to prevent perforation and a running sore. I took off the breast, which proved to be carcinomatous. The woman died some fourteen months later. When she died I found carcinoma going clear through the chest wall into the pleura and lung. All the glands which we had examined before and found enlarged were full of carcinoma. Undoubtedly the case was operable at one time. All carcinomata are operable at one time, but the tumor in her case was certainly inoperable when she came to the surgeon. This policy of waiting and seeing what it will do would be all right if we could induce our patients to come to us as often as we would like to have them, but there are too many things interfering, so that the favorable moment for operation is lost.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

MODERN ANÆSTHETICS. By J. Frederick W. Silk, M. D. Price $1.00 net. New York City: Longmans, Green & Co.

A REFERENCE HANDBOOK OF THE MEDICAL SCIENCES, Vol. III. Philadelphia: Wm. Wood & Co., 1914.

THEORIE UND PRAXIS DER BLUTENZIEHUNG. Nach dem Gegenwartigen Stande der Wissenschaft Bearbeitet. Von Prof. Dr. Heinrich Stern. Wurzburg: Verlag von Curt Kabitzsch, 1914.

MEDICAL GYNECOLOGY. The New (Third) Edition By S. Wyllis Bandler, M. D. Price $5.00 net. Philadelphia and London: W. B. Saunders Company, 1914.

THE AMERICAN ILLUSTRATED MEDICAL DICTIONARY. Seventh Edition. By W. A. Newman Dorland, A. M., M. D. Philadelphia and London: W. B. Saunders Company, 1913.

AN OPERATING THEATRE IN PRIVATE PRACTICE. By C. Hamilton Whiteford, M. R. C. S., L. R. C. P. London: Harrison & Sons.

ANNUAL REPORT OF THE SURGEON GENERAL OF THE PUBLIC HEALTH SERVICE.

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN GYNECOLOGY AND OBSTETRICS

By GEORGE GELLHORN, M. D., Saint Louis, Missouri

ANY new textbook, in order to justify its appearance, should either introduce new observations which add to the sum of medical knowledge, or else must present well established facts in a better and more comprehensive form than heretofore accomplished. As far as Reed's new book[1] is concerned, the author himself disavows any claim to original contributions, aiming merely "to give the actual status of each subject as it existed in gynecologic science at the moment of writing." It must be conceded that he attacks his problem in a novel and interesting fashion. He includes in his study the organs of reproduction, the urinary system, the rectum, and the breast.

Contrary to the usual custom of discussing the various congenital and acquired affections of each organ in turn, he divides the book into sections dealing with malformations, injuries, displacements, foreign bodies, infections, neoplasms, and trophic changes; and under the head of each topic he describes successively the conditions as they present themselves in the various organs. For example, the section on injuries is subdivided into eleven chapters devoted to injuries of the vulva, perineum, vagina, uterus, tubes, ovaries, urethra, bladder, ureters, kidney, and rectum respectively. Such an arrangement of the subject appears most appropriate and logical, for instance, in bacteriologic diseases when the gonococcus infection is traced throughout the genito-urinary tract, or in the chapter on tuberculosis where the pathology, symptomatology and therapy of tuberculous infection of the vulva, vagina, cervix, and corpus uteri, tubes, ovaries, pelvic peritoneum, bladder, kidney, rectum, and breast are discussed in sequence. Where, however, such an etiologic classification is not feasible, a morphologic classification is substituted—as, for example, in the section on neoplasms. In this section, the fibromyomatous tumors of all the organs which are within the scope of the book are discussed first; then follow the various malignant neoplasms; and, finally, all cystic growths irrespective of their etiology. In another section, the foreign bodies which may have been introduced into vagina, uterus, urethra, and rectum are treated together with calculi which have developed within ureters, kidney, and urachus; and the necessity of thus throwing together heterogeneous material emphasizes the difficulty of establishing any classification which will answer all requirements. Such inevitable inconsistency, however, appears insignificant when we consider the terseness of language, the fluency of style, and the expository skill of the author, all of which render the study of this book both pleasant and fascinating.

The section on menstruation and its disorders has been written by Dr. Dan Millikin, of Hamilton, Ohio, and this contribution in its attractive expression and original conception ranks high above the customary treatment of the subject.

The concluding sections deal with methods of examination and diagnosis and with general procedures in abdominal operations, and though rather brief, they also excel in clearness of description.

This short synopsis of the contents of the book has shown that we have to deal with an unusual literary production, but while we willingly acknowledge the great merits of the book, we cannot subscribe to certain statements contained therein.

The assertion that gynecology is a department of general surgery is bound to meet with opposition. As a matter of historic development, gynecology as a specialty owes its origin to obstetrics, and although in America the line of demarcation between gynecology and general surgery has not been very sharp in the past, yet there are signs that specialization in our particular field is growing stronger and will, in another generation, occupy the position it holds in other countries. The old division of medical science into medicine and surgery has long become obsolete, and ophthalmology and laryngology as well as gynecology have, for many years, ceased to be departments of general surgery. It would be well, perhaps, to recognize the full extent of the evolution of medicine which makes it impossible for any one man, however well informed, to master more than a fairly limited field of medical therapeutics.

The illustrations are, for the most part, in the nature of blackboard sketches as the author somewhat contemptuously criticizes the "mere picture book idea of conventional illustrations." Yet the value of adequate illustrations can not be overestimated. Kelly's "Operative Gynecology" with Broedel's masterly pictures, in 1899, marked a new era and revolutionized the art of medical illustrations both in this country and abroad where its influence can plainly be seen in such works as Bumm's "Obstetrics" and the "Operative

[1] Diseases of Women — Medical and Surgical Gynecology. By Charles A. L. Reed, A. M., F. A. C. S., M. D. New York and London: D. Appleton and Co., 1913.

Gynecology" by Doederlein and Krönig. In spite of the truly graphic descriptions by Reed, it can not be gainsaid that the beginner whose actual experience is as yet limited would profit vastly from more accurate illustrations.

THIS textbook has grown out of the author's "Diagnosis of Diseases of Women" which was the first and for a time the only American work on gynecological diagnosis.[1] The good features which distinguished this book reappear in the large volume before us. The author recognizes the principle that the correct interpretation of symptoms rests primarily upon a thorough knowledge of the morbid anatomy, and he therefore pays particular attention to a detailed description of both the macroscopic and microscopic structure of the affected parts.

The general practitioner will welcome the chapters on conservative methods of treatment such as douches, baths, massage, diet, and tampons, for these non-operative measures have not received their due share of consideration in textbooks and in practice which they rightly deserve. In these days when gynecology is in danger of becoming merely a surgical specialty, the gynecologist, too, should make himself conversant with every non-operative measure which may promise relief. For this reason, pessaries might have been given a little more space than the author reserves for them. For prolapse of the uterus when operation is deemed inadvisable, the author recommends the old cup and stem pessary attached to an abdominal support. The reviewer would venture the opinion that the Menge and Loehlein pessaries have rendered the McIntosh pessary obsolete.

In the matter on hygiene, dress, and exercise, the author shows himself in line with the best teachings of the day. This chapter, short as it is, will be of greatest value to the practitioner in that it will enable him to forestall disease by his wise counsel.

In the subject matter itself we find here and there cause for dissenting views. In discussing cervical lacerations (p. 125), the author claims "that this relatively slight local injury may cause a widespread perturbation of nerve function." Such a doctrine is not altogether in accord with modern thought. Among the operations for cancer of the cervix uteri the Schauta method of extended vaginal hysterectomy is not mentioned, and the description of the Wertheim method is too short to be of practical value. The same is true of ureteral catheterization by means of the Nitze cystoscope, a procedure which would demand more than a line or two of descriptive text. Referring to spinal anæsthesia (p. 850), the author completely omits giving credit to Bier and recommends the old technique of Tuffier which has long since been improved in almost every detail. Among the various methods of cæsarean section, neither the high incision of Davis nor the extra- and transperitoneal procedures of the German writers are considered.

While the author has not fully succeeded in giving "the actual status of each subject as it existed in gynecologic science at the moment of writing," yet he reveals himself as so strong a personality and his book contains so many unusual and attractive features that this work should find a place in the library of every practitioner who attempts the treatment of diseases of women.

The chapter on post-operative complications and their treatment will doubtless be consulted with advantage by many and help in numerous instances to turn the scale in favor of the patient.

This review cannot be closed without a word of appreciation of the chapter on diseases of the urinary system. This field is no longer on the borderline between gynecology and surgery. The genital and urinary systems in the female are so closely allied both topographically and developmentally that familiarity with this topic has become an absolute necessity to the modern gynecologist.

May we not ask the author to eliminate biblical references in future editions of this book? If, for example, he believes that pregnancy may occur after the menopause (p. 68), he should be able to cite more recent cases than that of "Abraham who was one hundred years of age and Sarah ninety when their child was born."

In a work of this size, debatable points are bound to occur. One can, for instance, hardly agree with the author when he dismisses, in less than four lines, the subject of spinal anæsthesia notwithstanding the fact that this method has become the sovereign one in gynecologic operations in Germany and France and is just now having a renaissance in this country. But such points of difference are easily overlooked in weighing the value of the entire book, which has been written in so concise a manner and which so clearly portrays the author's qualifications as an excellent teacher that we do not hesitate to warmly recommend this textbook to the profession.

THIS volume[2] is the continuance of the complete review of the subjects arranged alphabetically. The third volume contains the same exhaustive consideration of the various topics which characterized the two former volumes and is worthy of the same commendation.

[1] DISEASES OF WOMEN — A TREATISE FOR STUDENTS AND PRACTITIONERS. By Palmer Findley, B. S., M. D. Philadelphia and New York: Lea & Febinger, 1913.

[2] A REFERENCE HANDBOOK OF THE MEDICAL SCIENCES, VOL. III, 1914. Philadelphia: Wm. Wood & Co.

Clinical Congress of Surgeons of North America

FIFTH ANNUAL SESSION

LONDON, ENGLAND

WEEK OF JULY 27, 1914

THE LONDON COMMITTEE

Honorary Chairman: SIR RICKMAN J. GODLEE

Honorary Secretaries: MR. HERBERT J. PATERSON, MR. HERBERT S. PENDLEBURY

DEPARTMENT CHAIRMEN

Surgery of the Eye—MR. W. H. H. JESSOP Surgery of the Ear—MR. ARTHUR H. CHEATLE

Surgery of the Nose and Throat—SIR ST. CLAIR THOMSON

HOSPITAL COMMITTEE

St. Bartholomew's — MR. MCADAM ECCLES.
St. Thomas's — MR. CUTHBERT WALLACE.
Westminster — MR. WALTER SPENCER.
Guy's — MR. C. H. FAGGE.
St. George's — Mr. H. S. PENDLEBURY.
London — MR. J. SHERREN.
Middlesex — MR. T. H. KELLOCK.
University — MR. R. JOHNSON.
St. Mary's — MR. W. H. CLAYTON GREENE.
King's College — MR. F. F. BURGHARD.
Charing Cross — MR. H. S. CLOGG.
Royal Free — MR. JAMES BERRY.
Metropolitan — MR. MAYNARD HEATH.
Cancer — MR. C. RYALL.
Hospital for Sick Children — MR. G. E. WAUGH.
West London — MR. TYRRELL GRAY.
National — MR. PERCY SARGENT.
St. Peter's — MR. J. THOMSON WALKER.
Prince of Wales' — MR. H. W. CARSON.
Hampstead — MR. J. JACKSON CLARKE.
St. Marks — MR. P. LOCKHART MUMMERY.
New Hospital for Women — MISS ALDRICH BLAKE.
Chelsea Hospital for Women — DR. T. W. EDEN.
Royal London Ophthalmic — MR. A. C. HUDSON.
Seaman's — MR. C. C. CHOYCE.
Royal Ear — MR. J. F. O'MALLEY.
Hospital for Diseases of the Throat — Mr. G. W. BADGEROW.
Royal Westminster — MR. W. H. MCMULLEN.
Central London Throat and Ear Hospital — MR. DAN MCKENZIE.
Samaritan Free Hospital for Women — DR. F. J. MCCANN.
Royal National Ophthalmic — MR. A. H. TUBBY.
Central London Ophthalmic — MR. STEPHEN MAYOU.

CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA

GEORGE EMERSON BREWER, President
W. W. CHIPMAN, Vice-President
ALLEN B. KANAVEL, General Treasurer
JOHN B. MURPHY, President-Elect
GEORGE E. ARMSTRONG, Vice-President-Elect
A. D. BALLOU, General Manager
FRANKLIN H. MARTIN, General Secretary

OFFICERS OF THE LONDON COMMITTEE

Honorary Chairman: SIR RICKMAN J. GODLEE
Honorary Secretaries: MR. HERBERT J. PATERSON, MR. HERBERT S. PENDLEBURY

THE CLINICAL CONGRESS OF SURGEONS

THE 1914 session of the Clinical Congress bids fair to be a great success, not only in point of scientific interest, but in the number who expect to attend the meeting.

The complete clinical program given on the following pages is comprehensive in its scope and cannot help but be attractive to those interested in surgery and the surgical specialties. This program, however, is only an outline of what the work will be. The daily program as it will be bulletined at headquarters each day will be more extensive and will give in detail the nature of the operative work and demonstrations.

Among the clinicians you will note the names of the leading surgeons of London, and among the institutions where the clinics and demonstrations are to be held, the principal hospitals and medical schools of the great city. The entire field of surgery is covered and one will find enough actual surgical work along any one line to keep him busy from morning to night each day of the session. In addition to clinics in operative surgery, a large number of special demonstrations in radiology, experimental surgery, surgical pathology, etc., will be provided.

The plan of the evening sessions is unique and has proved in the recent meetings of the Congress one of the most attractive features of the organization. By referring to the detailed program on the following pages, it will be noted that the orators have been selected because of their special fitness to present the last word on their respective subjects. It is not a program of volunteers, but a selection of those best qualified from the clinics of Great Britain, Europe, and America. The men who discuss the papers have also been carefully selected because of their special fitness to speak on the subject assigned.

The rules of the Congress limit the reading of the papers to twenty-five minutes and each discussion to ten minutes. As there are no voluntary papers or discussions, the sessions are definite, to the point, and are not allowed to drag on to the point of tediousness.

For the benefit of those who may have overlooked the matter published during the past few months, we reprint herewith the detailed arrangements which have been made with regard to registration, headquarters, daily bulletins of clinics, etc., together with the clinical and evening programs corrected to date.

HEADQUARTERS OF THE CONGRESS

The headquarters of the Congress are ideal. The embankment suites of entertainment halls of the capacious Hotels Cecil and Savoy, located side by side in the hospital center of London, have been secured for the registration rooms, exhibition halls, and evening meeting rooms. These great hostelries, with their combined capacity for more than fifteen hundred guests, are located

within a stone's throw of many of the other famous hotels of London.

Surgeons on reaching London should proceed at once to the headquarters at the Hotel Cecil, register, and receive their membership cards and tickets which will admit them to the evening meetings and to the clinics. The registration fee is five dollars, or twenty-one shillings.

Those who prefer to do so may register in advance, and receive their credentials, by sending the amount of the fee to the General Secretary, Clinical Congress of Surgeons, 30 North Michigan Avenue, Chicago, *before July 1st;* after which time remittance should be sent to the London office of the Congress, No. 1 Wimpole St., London, W., England.

BULLETIN ROOMS

The bulletin rooms for the Congress will be at the Hotel Cecil.

The program for Monday, July 27th, will be bulletined on Saturday afternoon, July 25th, two days before the opening of the Congress. In the afternoon of each day of the session a complete, accurate program of the clinics and demonstrations to be given on the succeeding day will be posted on the bulletin board. The registration and bulletin rooms will also be open on Sunday, July 26th, for the accommodation of early arrivals.

MEMBERSHIP IN THE CONGRESS

Any physician or surgeon legally qualified to practice surgery in his community may become a member of the Clinical Congress by registering at any annual meeting and paying the registration fee.

Automatically the subscribers to SURGERY, GYNECOLOGY AND OBSTETRICS, the official journal of the Congress, will receive invitations without request. Other members of the profession who desire to attend will receive formal invitations upon request to Franklin H. Martin, M. D., General Secretary, 30 North Michigan Avenue, Chicago, or to No. 1 Wimpole St., London, W.

REGISTRATION FEE — ADVANCE REGISTRATION

A registration fee is required of each surgeon upon registration, at which time a membership card will be issued as stated above. North American surgeons who wish credentials to enable them to secure reduced steamship rates may register in advance and receive certificate of membership. The registration fee of five dollars should be sent to the General Secretary, 30 N. Michigan Avenue, Chicago, *before July 1st*, or to No. 1 Wimpole St., London, W., *after July 1st.*

Unlike conditions prevailing in most medical societies, where annual dues are paid by each member without regard to his attendance at any meeting of the society, the payment of a registration fee is required of a member of the Congress only when he is in attendance at an annual session.

The purpose of this fee is to provide funds to meet the expenses of preparing for and conducting the annual meeting, in order that no financial burden other than the registration fee may be imposed upon the members of the profession in the city entertaining the Congress. Judging from past experience, the amount received from such fees will be barely sufficient for the purpose, so that payment of the fee is expected of all who attend the clinics or evening sessions.

RESERVED SEATS FOR CLINICS

Reserved tickets for all clinics and demonstrations, numbered and couponed, corresponding to the capacity of each operating room, will be issued, and may be secured at headquarters.

A tentative program will be furnished to all prospective attendants of the Congress who apply for the same. The program will be printed in SURGERY, GYNECOLOGY AND OBSTETRICS, the official journal of the Congress, and in other medical journals. From this program one may make his selection of the clinics he wishes to attend and send a written request for reserved tickets to Mr. A. D. Ballou, General Manager, No. 1 Wimpole St. London, W., stating definitely for just what clinics the tickets are desired. These tickets will be retained at headquarters up to a certain fixed time (to be determined and announced later) in the name of the applicant, and will be assigned as nearly as possible in order of application. That the applicants may not be disappointed if the tickets for their first choice are exhausted, several selections should be made.

MEMBERSHIP CARDS

Each surgeon who desires to attend the clinics and evening sessions must register at headquarters and secure a membership card. Admission to all clinics and evening sessions will be limited strictly to members of the Congress upon presentation of such membership cards.

THE EVENING MEETINGS

Evening meetings will be held simultaneously in two halls, the general surgical program to be given in the Grand Hall of the Hotel Cecil and the program of the specialties, Surgery of the Eye, Ear, Nose and Throat, and Oral Surgery in the Ballroom of the Hotel Savoy.

The meetings will begin at 8:30 o'clock and adjourn not later than 11:45. The principal papers are to be read by visiting surgeons and a time limit of twenty-five minutes has been fixed for each address. The papers are to be discussed by London surgeons and the discussions limited to ten minutes each.

ENTERTAINMENTS

It has been the policy of the Clinical Congress of Surgeons to discourage large entertainments of a social nature. The time is so carefully arranged and occupied by scientific meetings and clinics that there is no proper time for social functions. Then, too, the Congress of necessity must always be held in large cities where there is much of general interest in the way of theaters, museums, and art galleries, which affords entertainment for those seeking occasional recreation and for the accompanying ladies. This plan has worked out so well in other cities where sessions of the Congress have been held that it is hoped the same policy will be observed in London. It must be remembered that the burden to the profession or a municipality of entertaining large medical societies in recent years has become so great as to be almost prohibitive.

SAILING ACCOMMODATIONS

It is urged that accommodations for going and return passage be arranged for at the earliest possible date. The Transportation Manager of the Congress is in a position to obtain excellent accommodations on any of the leading steamship lines at rates that will suit the financial requirements of the inquirer. Reservations can be made on some of the late sailing fast steamers, whereby a surgeon may attend the Congress and return with the loss of but three weeks' time.

REDUCED RATES

A special reduction of 25 per cent to members of the Clinical Congress and their immediate families has been made by the different steamship lines as given below:

Cunard Line, eastbound on or after July 7; westbound on or before August 27.

Allan Line, eastbound on or after July 2; westbound on or before August 28.

The International Mercantile Marine Lines, which include the *White Star, Atlantic Transport, American Line*, and *Red Star Line*, eastbound on or after July 2; westbound on or before August 28.

The Hamburg-American Line, eastbound on or after July 7th; westbound on or before August 15, except that the reduction will be available on the steamship Amerika sailing on August 22 for Boston.

The North German Lloyd Line, eastbound on or after July 7th; westbound on or before August 27.

The Holland-American Line, eastbound on or after July 14; westbound on or before August 28.

The Canadian Northern, eastbound on or after July 14th; westbound on or before August 28.

The Leyland Line, eastbound on or after July 4; westbound, on or before August 28.

A complete list of the eastbound steamers on which the reduction is obtainable is given on page xlvii of the advertising section of this journal.

It is important to note that the minimum first-class rate must be adhered to; under no circumstances can the fare be less than the minimum rate.

For further information, address either the General Secretary, 30 N. Michigan Avenue, Chicago, or the Transportation Manager, Mr. J. P. McCann, Marbridge Building, New York City.

LONDON HOTELS

In addition to the Cecil and Savoy, the Headquarters of the Congress, there are a large number of hotels centrally located which have agreed to make advance reservations for members of the Congress. These hotels include, among others, the Carlton, Metropole, Grand, Victoria, Grosvenor, Imperial, Russell, Waldorf, Ritz, Piccadilly, Great Central, First Avenue, Richelieu, St. Ermins, Hans Crescent, Windsor, Langham, Royal Palace, and De Keysers Royal.

While there will be no difficulty in securing hotel accommodations somewhere in London during the week of the Congress, it is advisable to make reservations early.

SURGEONS' INTERNATIONAL GOLF MATCH

NOTICE.— It is proposed to arrange a golf match between teams representing London surgeons and North American surgeons, on one afternoon during the week of the Congress. Arrangements will be made for the matches to take place at seven or eight of the numerous courses around London. In this way it will be possible to arrange for 50 or 100 couples to take part without crowding, as the number of couples playing on the same course will be limited to ten or twelve.

Members of the Congress who desire to play are requested to send their names and handicap to Mr. Herbert Paterson, at the London Office of the Congress, 1 Wimpole St. W.

PROGRAM OF EVENING SESSIONS

General Surgical Division

Presidential Meeting, Monday, July 27th, in the Grand Hall, Hotel Cecil

Formal Opening.

Address of Welcome by Sir Rickman J. Godlee, Honorary Chairman of the London Committee.

Welcome to American Surgeons, by the Honorable Walter Hines Page, American Ambassador.

George Emerson Brewer, M. D., New York City: Address of retiring president.

Inauguration of President John B. Murphy and Vice-President George E. Armstrong.

Professor A. von Eiselsberg, Vienna: The Choice of the Operative Method for Ulcer of the Stomach.
Discussion by Sir Watson Cheyne and Mr. James Sherren.

John B. Murphy, M. D., Chicago, Presidential Address: Arthrodesis and Bone Transplantation; Its Limitations and Technique.

Tuesday, July 28th, in the Grand Hall, Hotel Cecil

Professor Tuffier, Paris: Transplantation of Ovaries.
Discussion by Sir John Bland-Sutton.

Henry Jellett, F. R. C. P., Dublin: The Use of the Levator-Ani Muscle and the Utero-Sacral Ligament in Prolapse Treatment.
Discussion by Dr. Herbert Spencer, London.

Robert Jones, F. R. C. S., Liverpool: Certain Derangements of the Knee Joint and Their Treatment.
Discussion by Mr. A. H. Tubby and Mr. Robert Milne.

Wednesday, July 29th, in the Grand Hall, Hotel Cecil

George E. Armstrong, M. D., Montreal: Typhoid Perforation.
Discussion by Sir Anthony Bowlby, F.R.C.S., London.

Charles H. Mayo, M. D., Rochester: Primary and Late Results of Operations for Exophthalmic Goiter or Hyperthyroidism.
Discussion by James Berry, F. R. C. S.

Thursday, July 30th, in the Grand Hall, Hotel Cecil

Professor Doctor Krönig, Freiburg, Germany: The Principles of Non-Operative Treatment of Carcinoma.

James F. Percy, M. D., Galesburg, Illinois: The Treatment of Inoperable Carcinoma of the Uterus by the Application of Heat.

Thomas Wilson, F. R. C. S., Birmingham: Cancer of the Uterus.
Discussion by Thomas Watts Eden, F. R. C. S., W. W. H. Tate, M. R. C. S., W. E. Miles, F. R. C. S., London; and Dr. Joseph Colt Bloodgood, Baltimore.

Friday, July 31st, in the Grand Hall, Hotel Cecil

E. Wyllys Andrews, M.D., Chicago: Cure of Hernia by Tissue Inlaying or Fascial Implantation.
Discussion by Lawrie Hugh McGavin, F. R. C. S.

Sir William Osler, Bart., Oxford: Intestinal Stasis.

Sir Berkeley Moynihan, Leeds: Intestinal Stasis.

Joseph Colt Bloodgood, M. D., Baltimore: Surgery of Intestinal Stasis.
Discussion by Sir Arbuthnot Lane, Bart.

PROGRAM OF EVENING SESSIONS — *Continued*

DIVISION OF SURGICAL SPECIALTIES

Tuesday, July 28th, in the Ballroom of the Hotel Savoy

PROFESSOR E. SCHMIEGELOW, Copenhagen, Denmark: The Results of Operations (Laryngofissure) for Intrinsic Cancer of the Larynx.
Discussion by SIR ST. CLAIR THOMSON, London.

DR. J. M. WEST, Berlin, Germany: The Intranasal Surgery of the Lachrymal Apparatus, after an Experience with over 225 Operations.
Discussion by DR. D. R. PATERSON of Cardiff.

CHARLES W. RICHARDSON, M. D., Washington, D. C.: Congenital Atresia of the Post Nasal Orifice.

Wednesday, July 29th, in the Ballroom of the Hotel Savoy

DR. A. LOGAN TURNER, Edinburgh: The Application of Skiagraphy to the Mastoid Region and Its Use in the Detection of Disease.
Discussion by MR. SIDNEY SCOTT, London.

MR. HUGH E. JONES, Liverpool, England: Some Considerations which Determine the Extent of an Operation in Septic Invasion of the Lateral Sinus.
Discussion by MR. HUNTER TOD, London.

F. H. WESTMACOTT, F. R. C. S., Manchester: Internal Ophthalmoplegia of Otitic Origin.
Discussion by Dan McKenzie, M. D., F. R. C. S., London.

Thursday, July 30, in the Ballroom of Hotel Savoy

Symposium on Surgery of the Cleft Palate. (Papers to be limited to fifteen minutes each.)

ROBERT W. MURRAY, F. R. C. S., Liverpool.

F. W. GOYDER, M. D., F. R. C. S., Bradford.

JOHAN ULRICH, Copenhagen, Denmark.

TRUMAN W. BROPHY, M. D., Chicago.

GEORGE V. I. BROWN, M. D., Milwaukee, Wisconsin.

JOSEPH R. EASTMAN, M. D., Indianapolis, Indiana.

DR. ERNST KAERGER, Berlin.

Discussions limited to ten minutes each, by Sir William Arbuthnot Lane, London; Edmund Owen, M. B., F. R. C. S., London; James Berry, M. B., F. R. C. S., London; Professor Keith, London; T. Percy Legg, M. S., F. R. C. S., London; and Dr. Edward S. Judd, Rochester, Minnesota.

Friday, July 31st, in the Ballroom of the Hotel Savoy

R. H. ELLIOTT, Lt. Col., I. M. S., Madras, India: The Sclero-Corneal Trephining Operation for Glaucoma.
Discussed by MR. TREACHER COLLINS.

MR. F. RICHARDSON CROSS, Bristol: Operative Procedure for Strabismus.
Discussion by MR. N. BISHOP HARMAN, London.

DR. JOHN B. STORY, Dublin: The Operation for Senile Cataract.
Discussion by MR. HOLMES SPICER.

PRELIMINARY CLINICAL PROGRAM

SURGICAL CLINICS

Monday, July 27th

MR. D'ARCY POWER — St. Bartholomew's Hospital — 1:30.
MR. H. J. WARING — St. Bartholomew's Hospital — 1:30.
MR. C. GORDON WATSON — St. Bartholomew's Hospital — 3:30.
MR. HAROLD W. WILSON — St. Bartholomew's Hospital — 1:30.
MR. R. C. ELMSLIE — St. Bartholomew's Hospital — 3:30.
MR. H. B. ROBINSON — St. Thomas' Hospital — 2 to 5.
MR. CUTHBERT WALLACE — St. Thomas' Hospital — 2 to 5.
MR. J. E. ADAMS — St. Thomas' Hospital — 9 to 12.
MR. E. ROCK CARLING — Westminster Hospital — 9.
MR. A. H. TUBBY — Westminster Hospital — 2.
SIR ARBUTHNOT LANE — Guy's Hospital — 2.
MR. L. A. DUNN — Guy's Hospital — 2.
MR. F. J. STEWARD — Guy's Hospital — 2.
MR. C. H. FAGGE — Guy's Hospital — 2.
MR. R. P. ROWLANDS — Guy's Hospital — 2.
MR. P. TURNER — Guy's Hospital — 9.
MR. E. C. HUGHES — Guy's Hospital — 2.
MR. R. DAVIES-COLLEY — Guy's Hospital — 9.
MR. A. R. THOMSON — Guy's Hospital — 9.
MR. H. S. PENDLEBURY — St. George's Hospital — 1:30 to 4.
MR. T. CRISP ENGLISH — St. George's Hospital — 1:30 to 4.
SIR FREDERIC EVE — London Hospital — 2.
MR. HUGH LETT — London Hospital — 9.
SIR A. PEARCE GOULD and MR. W. S. HANDLEY — Middlesex Hospital — 1:30.
MR. A. E. BARKER — University College Hospital — 9.
MR. BILTON POLLARD — University College Hospital — 2.
MR. V. Z. COPE — St. Mary's Hospital — 9.
SIR WATSON CHEYNE — King's College Hospital — 2.
MR. A. CARLESS — King's College Hospital — 9.
MR. T. P. LEGG — King's College Hospital — 9.
MR. A. EDMUNDS — King's College Hospital — 2.
MR. H. F. WATERHOUSE — Charing Cross Hospital — 2 to 5.
MR. JAMES BERRY — Royal Free Hospital — 2 to 5.
MR. W. ASHDOWNE — Metropolitan Hospital — 2.
MR. J. CUNNING and MR. CECIL ROWNTREE — Cancer Hospital — 2.
MR. E. M. CORNER — Hospital for Sick Children — 9 to 12.
MR. TYRRELL GRAY — Hospital for Sick Children — 2 to 5.
MR. D. ARMOUR — West London Hospital — 2.
MR. E. GILLESPIE — Prince of Wales General Hospital — 1:30 to 4:30.
MR. LOCKHART MUMMERY — St. Mark's Hospital — 2:30.
MISS CHADBURN — New Hospital for Women — 2.

Tuesday, July 28th

MR. W. McADAM ECCLES — St. Bartholomew's Hospital — 1:30.
MR. R. COZENS BAILEY — St. Bartholomew's Hospital — 1:30.
MR. R. C. ELMSLIE — St. Bartholomew's Hospital — 1:30.
MR. G. H. MAKINS — St. Thomas' Hospital — 2 to 5.
MR. W. H. BATTLE — St. Thomas' Hospital — 2 to 5.
MR. C. A. BALLANCE — St. Thomas' Hospital — 2 to 5.
MR. H. B. ROBINSON — St. Thomas' Hospital — 9 to 12.
MR. CYRIL NITCH — St. Thomas' Hospital — 9 to 12.
MR. W. G. SPENCER — Westminster Hospital — 2.
SIR ARBUTHNOT LANE — Guy's Hospital — 2.
MR. L. A. DUNN — Guy's Hospital — 2.
MR. F. J. STEWARD — Guy's Hospital — 2.
MR. C. H. FAGGE — Guy's Hospital — 2.
MR. R. P. ROWLANDS — Guy's Hospital — 2.
MR. P. TURNER — Guy's Hospital — 2.
MR. E. C. HUGHES — Guy's Hospital — 2.
MR. W. H. TRETHOWAN — Guy's Hospital — 2.
MR. G. R. TURNER — St. George's Hospital — 1:30 to 4.
MR. F. JAFFREY — St. George's Hospital — 1:30 to 4.
MR. H. M. RIGBY — London Hospital — 2.
MR. JAMES SHERREN — London Hospital — 9.
MR. R. WARREN — London Hospital — 2.
MR. F. KIDD — London Hospital — 2.
MR. JOHN MURRAY and MR. ALFRED JOHNSON — Middlesex Hospital — 1:30.
MR. T. H. KELLOCK and MR. GORDON TAYLOR — Middlesex Hospital — 1:30.
MR. RAYMOND JOHNSON — University College Hospital — 9.
MR. WILFRED TROTTER — University College Hospital — 2.
MR. WARREN LOW — St. Mary's Hospital — 9 and 2.
MR. F. F. BURGHARD — King's College Hospital — 2.
MR. G. L. CHEATLE — King's College Hospital — 9:30.
MR. STANLEY BOYD — Charing Cross Hospital — 2 to 5.
MR. W. H. EVANS — Royal Free Hospital — 2 to 5.
MR. H. CURTIS — Metropolitan Hospital — 2.
MR. JOCELYN SWAN and MR. H. W. WILSON — Cancer Hospital — 2.
SIR ARBUTHNOT LANE — Hospital for Sick Children — 9 to 12.
MR. GEORGE WAUGH — Hospital for Sick Children — 2 to 5.
MR. A. BALDWIN — West London Hospital — 2.
MR. O. L. ADDISON — West London Hospital — 9.
SIR VICTOR HORSLEY — National Hospital — 10. Surgery of the head and nervous system.
MR. H. W. CARSON — Prince of Wales General Hospital — 1:30 to 4:30.
MISS ALDRICH BLAKE — New Hospital for Women — 2.

Wednesday, July 29th

SIR ANTHONY BOWLBY — St. Bartholomew's Hospital — 2:30.
MR. H. J. WARING — St. Bartholomew's Hospital — 1:30.
MR. W. GIRLING BALL — St. Bartholomew's Hospital — 1:30.
MR. G. H. MAKINS — St. Thomas' Hospital — 2 to 5.
MR. W. H. BATTLE — St. Thomas' Hospital — 2 to 5.
MR. C. A. BALLANCE — St. Thomas' Hospital — 2 to 5.
MR. H. B. ROBINSON — St. Thomas' Hospital — 2 to 5.
MR. E. M. CORNER — St. Thomas' Hospital — 9 to 12.
MR. PERCY SARGENT — St. Thomas' Hospital — 9 to 12.
MR. C. STONHAM — Westminster Hospital — 2.
MR. J. M. G. SWAINSON — Westminster Hospital — 9.
MR. IVOR BACK — St. George's Hospital — 9:15 to 11.
MR. C. H. FRANKAU — St. George's Hospital — 9:15 to 11.
MR. J. HUTCHINSON — London Hospital — 2.
MR. R. MILNE — London Hospital — 2.
MR. A. J. WALTON — London Hospital — 9.
SIR JOHN BLAND-SUTTON and MR. GORDON TAYLOR — Middlesex Hospital — 1:30.
MR. RAYMOND JOHNSON — University College Hospital — 2.
MR. MAYNARD SMITH — St. Mary's — 9.
SIR WATSON CHEYNE — King's College Hospital — 9:30.
MR. A. CARLESS — King's College Hospital — 2.
MR. T. P. LEGG — King's College Hospital — 2.
MR. CHARLES GIBBS — Charing Cross Hospital — 2 to 5.
MR. JAMES BERRY — Royal Free Hospital — 2 to 5.
MR. J. CUNNING — Royal Free Hospital — 2 to 5.
MR. P. L. DANIEL — Metropolitan Hospital — 10.
MR. C. RYALL — Cancer Hospital — 2.
MR. T. H. KELLOCK — Hospital for Sick Children — 9 to 12.
MR. L. E. BARRINGTON-WARD — Hospital for Sick Children — 2 to 5.
MR. J. S. PARDOE — West London — 2.
MR. P. J. FREYER — St. Peters — 2.
MR. J. W. THOMSON WALKER — St. Peter's Hospital — 2.
MR. J. HOWELL EVANS — Prince of Wales General Hospital — 9:30 to 12:30.
MR. JACKSON CLARKE — Hampstead General Hospital — 10.
MR. GEORGE WAUGH — Hampstead General Hospital — 10.
MR. SIDNEY BOYD — Hampstead General Hospital — 10.
MR. CHAD WOODWARD — Hampstead General Hospital — 10.
MR. ASLETT BALDWIN — St. Mark's Hospital — 2:30.
MISS GARRETT ANDERSON and MISS BOLTON — New Hospital for Women — 9.

Thursday, July 30th

MR. D'ARCY POWER — St. Bartholomew's Hospital — 1:30.
MR. R. COZENS BAILEY — St. Bartholomew's Hospital — 1:30.
MR. L. BATHE RAWLING — St. Bartholomew's Hospital — 1:30.
MR. G. E. GASK — St. Bartholomew's Hospital — 3:30.
MR. H. B. ROBINSON — St. Thomas' Hospital — 2 to 5.
MR. CUTHBERT WALLACE — St. Thomas' Hospital — 2 to 5.
MR. E. M. CORNER — St. Thomas' Hospital — 2 to 5.
MR. J. E. ADAMS — St. Thomas' Hospital — 9 to 12.
MR. W. TURNER — Westminster Hospital — 9.
SIR ARBUTHNOT LANE — Guy's Hospital — 2.
MR. F. J. STEWARD — Guy's Hospital — 2.
MR. C. H. FAGGE — Guy's Hospital — 2.
MR. P. TURNER — Guy's Hospital — 2.
MR. E. C. HUGHES — Guy's Hospital — 2.
MR. R. DAVIES-COLLEY — Guy's Hospital — 2.
MR. G. R. TURNER — St. George's Hospital — 1:30 to 4.
MR. T. CRISP ENGLISH — St. George's Hospital — 1:30 to 4.
MR. W. FEDDE FEDDEN — St. George's Hospital — 9:15 to 11.
MR. IVOR BACK — St. George's Hospital — 9:15 to 11.
MR. C. H. FRANKAU — St. George's Hospital — 9:15 to 11.
MR. T. H. OPENSHAW — London Hospital — 2.
MR. RUSSELL HOWARD — London Hospital — 9.
MR. F. KIDD — London Hospital — 2.
SIR A. PEARCE GOULD and MR. W. S. HANDLEY — Middlesex Hospital — 1:30.
MR. A. E. BARKER — University College Hospital — 2.
MR. MORRISTON DAVIES — University College Hospital — 9.
MR. W. H. CLAYTON-GREEN — St. Mary's Hospital — 9 and 2.
MR. F. F. BURGHARD — King's College Hospital — 2.
MR. A. EDMUNDS — King's College Hospital — 2.
MR. H. F. WATERHOUSE — Charing Cross Hospital — 2 to 5.
MR. W. S. FENWICK — Charing Cross Hospital — 9 to 12.
MR. H. A. T. FAIRBANK — Charing Cross Hospital — 9 to 12.
MR. C. PANNETT — Royal Free Hospital — 2 to 5.
MR. W. E. MILES — Cancer Hospital — 2.
MR. H. A. T. FAIRBANK — Hospital for Sick Children — 2 to 5.
MR. O. L. ADDISON — Hospital for Sick Children — 9 to 12.
MR. H. W. CARSON — Prince of Wales General Hospital — 9:30 to 12:30.
MR. GORDON WATSON — St. Mark's Hospital — 2:30.
MISS CHADBURN — New Hospital for Women — 2.

Friday, July 31st

SIR ANTHONY BOWLBY — St. Bartholomew's Hospital — 1:30.
MR. W. McADAM ECCLES — St. Bartholomew's Hospital — 1:30.
MR. G. H. MAKINS — St. Thomas' Hospital — 2 to 5.
MR. W. H. BATTLE — St. Thomas' Hospital — 2 to 5.
MR. C. A. BALLANCE — St. Thomas' Hospital — 2 to 5.
MR. CYRIL NITCH — St. Thomas' Hospital — 2 to 5.
MR. ARTHUR EVANS — Westminster Hospital — 9.
SIR ARBUTHNOT LANE — Guy's Hospital — 2.
MR. L. A. DUNN — Guy's Hospital — 2.
MR. F. J. STEWARD — Guy's Hospital — 2.

MR. C. H. FAGGE — Guy's Hospital — 2.
MR. R. P. ROWLANDS — Guy's Hospital — 2.
MR. P. TURNER — Guy's Hospital — 2.
MR. E. C. HUGHES — Guy's Hospital — 2.
MR. W. H. TRETHOWAN — Guy's Hospital — 2.
MR. F. JAFFREY — St. George's Hospital — 1:30 to 4.
MR H. S. PENDLEBURY — St. George's Hospital — 1:30 to 4.
SIR FREDERIC EVE — London Hospital — 2.
MR. H. M. RIGBY — London Hospital — 9.
MR. JAMES SHERREN — London Hospital — 2.
MR. HUGH LETT — London Hospital — 2.
MR. JOHN MURRAY and MR. ALFRED JOHNSON — Middlesex Hospital — 1:30.
MR. T. H. KELLOCK and MR. GORDON TAYLOR — Middlesex Hospital — 1:30.
MR. BILTON POLLARD — University College Hospital — 2.
MR. WILFRED TROTTER — University College Hospital — 9.
MR. D. C. L. FITZWILLIAMS — St. Mary's Hospital — 9.
SIR WATSON CHEYNE — King's College Hospital — 2.
MR. A. CARLESS — King's College Hospital — 9:30.
MR. G. L. CHEATLE — King's College Hospital — 2.
MR. T. P. LEGGE — King's College Hospital — 9:30.
MR. A. EDMUNDS — King's College Hospital — 2.
MR. STANLEY BOYD — Charing Cross Hospital — 2 to 5.
MR. P. L. DANIELS — Charing Cross Hospital — 9 to 12.
MR. W. H. EVANS — Royal Free Hospital — 2 to 5.
MR. H. CURTIS — Metropolitan Hospital — 2.
SIR ARBUTHNOT LANE — Hospital for Sick Children — 9 to 12.
MR. O. L. ADDISON — Hospital for Sick Children — 2 to 5.
MR. H. S. SOUTTAR — West London Hospital — 9.
MR. F. SWINFORD EDWARDS — St. Peter's Hospital — 2.
MR. G. S. PARDOE — St. Peter's Hospital — 2.
MR. J. SWIFT JOLY — St. Peter's Hospital — 2.
MR. J. HOWELL EVANS — Prince of Wales General Hospital — 1:30 to 4:30.
MR. J. W. THOMSON WALKER — Hampstead General Hospital — 10.
MR. GEORGE WAUGH — Hampstead General Hospital — 10.
MR. SIDNEY BOYD — Hampstead General Hospital — 10.
MR. CHAD WOODWARD — Hampstead General Hospital — 10.
MISS ALDRICH-BLAKE — New Hospital for Women — 9.
MR. DONALD ARMOUR — National Hospital — 2. Surgery of the Head and Nervous system.
MR. PERCY SARGENT — National Hospital — 10. Surgery of the Head and Nervous System.

Saturday, August 1st

MR. W. FEDDE FEDDEN — St. George's Hospital — 1:30 to 4.
MR. IVOR BACK — St. George's Hospital — 1:30 to 4.
SIR JOHN BLAND-SUTTON and MR. GORDON TAYLOR — Middlesex Hospital — 1:30.
MR. MORRISTON DAVIES — University College Hospital — 9.
MR. F. F. BURGHARD — King's College Hospital — 9:30.
MR. G. L. CHEATLE — King's College Hospital — 2.
MR. CHARLES GIBBS — Charing Cross Hospital — 9 to 12.
MR. H. S. CLOGG — Charing Cross Hospital — 2 to 5.
MR. C. A. JOLL — Royal Free Hospital — 2 to 3.
MR. P. L. DANIEL — Metropolitan Hospital — 10.
MR. H. A. T. FAIRBANK — Hospital for Sick Children — 9 to 12.
MR. H. TYRRELL GRAY — West London Hospital — 9.
MR. E. GILLESPIE — Prince of Wales General Hospital — 9:30 to 12:30.

Days and Hours to be Announced

MR. MAYNARD SMITH — St. Mary's Hospital.

GYNECOLOGICAL CLINICS

Monday, July 27th

DR. W. S. A. GRIFFITH — St. Bartholomew's Hospital — 2.
DR. A. F. STABB and DR. G. F. DARWELL SMITH — St. George's Hospital — 9:15 to 11.
DR. DRUMMOND MAXWELL — London Hospital — 2.
DR. JOHN PHILLIPS — King's College Hospital — 2.
DR. A. E. GILES — Chelsea Hospital for Women — 9:30.
DR. S. DODD — Chelsea Hospital for Women — 9:30.
DR. C. H. ROBERTS — Samaritan Free Hospital for Women — 2.
DR. J. A. WILLETT — Samaritan Free Hospital for Women — 9.
DR. DARWELL SMITH — Samaritan Free Hospital for Women — 9.

Tuesday, July 28th

DR. J. BARRIS — St. Bartholomew's Hospital — 9:30.
DR. WALTER TATE — St. Thomas' Hospital — 2 to 5.
MR. H. CHAPPLE — Guy's Hospital — 9.
DR. COMYNS BERKELEY and DR. VICTOR BONNEY — Middlesex Hospital — 1:30.
DR. HERBERT SPENCER — University College Hospital — 9.
DR. T. G. STEVENS — St. Mary's — 9. (Obstetic Surgery.)
DR. HUGH PLAYFAIR — King's College Hospital — 2.
DR. T. W. EDEN and DR. C. H. LOCKYER — Charing Cross Hospital — 2 to 5.
MRS. VAUGHAN SAWYER — Royal Free Hospital — 2 to 5.

DR. W. H. FENTON — Chelsea Hospital for Women — 9:30.
DR. VICTOR BONNEY — Chelsea Hospital for Women — 9:30.
DR. J. B. BANISTER — Chelsea Hospital for Women — 9:30.
DR. DRUMMOND ROBINSON — West London Hospital — 9.
MR. J. D. MALCOLM — Samaritan Free Hospital for Women — 9.
DR. F. J. McCANN — Samaritan Free Hospital for Women — 2.

Wednesday, July 29th

DR. W. S. A. GRIFFITH — St. Bartholomew's Hospital — 2.
MR. G. B. SMITH — Guy's Hospital — 9.
DR. F. J. McCANN — Samaritan Free Hospital for Women — 2.
DR. C. LOCKYER — Samaritan Free Hospital for Women — 9.

Thursday, July 30th

DR. H. WILLIAMSON — St. Bartholomew's Hospital — 9:30.
DR. WALTER TATE — St. Thomas' Hospital — 9 to 12.
MR. H. CHAPPLE — Guy's Hospital — 9.
DR. DRUMMOND MAXWELL — London Hospital — 9:30.
DR. COMYNS BERKELEY and DR. VICTOR BONNEY — Middlesex Hospital — 1:30.
DR. GEORGE BLACKER — University College Hospital — 2.
DR. JOHN PHILLIPS — King's College Hospital — 2.
DR. H. G. PLAYFAIR and DR. EARDLEY HOLLAND — Metropolitan Hospital — 2.
DR. T. W. EDEN — Chelsea Hospital for Women — 9:30.
DR. F. L. PRORIS — Chelsea Hospital for Women — 9:30.
DR. ARTHUR GILES and DR. J. B. BANISTER — Prince of Wales General Hospital — 1:30 to 4:30.
MR. C. H. ROBERTS — Samaritan Free Hospital for Women — 9.
DR. F. J. McCANN — Samaritan Free Hospital for Women — 2.
DR. CLIFFORD WHITE — Samaritan Free Hospital for Women — 9.

Friday, July 31st

DR. W. S. A. GRIFFITH — St. Bartholomew's Hospital — 2.
DR. G. H. D. ROBINSON and DR. S. DODD — Westminster Hospital — 2.
MR. G. B. SMITH — Guy's Hospital — 9.
DR. A. F. STABB and DR. G. F. DARWELL SMITH — St. George's Hospital — 9:15 to 11.
DR. HUGH PLAYFAIR — King's College Hospital — 2.
DR. T. W. EDEN and DR. C. H. LOCKYER — Charing Cross Hospital — 2 to 5.
MRS. WILLEY — Royal Free Hospital — 9 to 12.
DR. COMYNS BERKELEY — Chelsea Hospital for Women — 9:30.
DR. H. J. F. SIMSON — West London Hospital — 2.
DR. ARTHUR GILES and DR. J. B. BANISTER — Prince of Wales General Hospital — 9:30 to 12:30.
MR. J. D. MALCOLM — Samaritan Free Hospital for Women — 2.
DR. C. LOCKYER — Samaritan Free Hospital for Women — 9.
DR. D. W. ROY — Samaritan Free Hospital for Women — 2.
DR. W. GILLIATT — Samaritan Free Hospital for Women — 9.

Saturday, August 1st

DR. HERBERT SPENCER — University College Hospital — 9.

Days and Hours to be Announced

DR. JOHN FAIRBAIRN and DR. J. P. HEDLEY — St. Thomas' Hospital.
DR. W. J. GOW — St. Mary's Hospital.

OPHTHALMOLOGICAL CLINICS

Monday, July 27th

MR. H. L. EASON — Guy's Hospital — 2.
MR. L. V. CARGILL — King's College Hospital — 2.
MR. H. W. LYLE — King's College Hospital.
MR. A. E. DORRELL — Prince of Wales General Hospital — 9:30 to 12:30.
MR. TREACHER COLLINS — Royal London Ophthalmic Hospital — 10.
Mr. C. A. WORTH. Royal London Ophthalmic Hospital — 10.
MR. M. L. HEPBURN — Royal London Ophthalmic Hospital — 10.
MR. A. C. HUDSON — Royal London Ophthalmic Hospital — 10.

Tuesday, July 28th

MR. W. H. JESSOP — St. Bartholomew's Hospital — 3.
MR. G. HARTRIDGE and MR. G. T. B JAMES — Westminster Hospital — 9.
MR. A. W. ORMOND — Guy's Hospital — 2.
MR. M. L. HEPBURN — Royal Free Hospital — 9 to 12.
MR. E. T. COLLINS — Charing Cross Hospital — 9 to 12.
MR. HOLMES SPICER — Royal London Ophthalmic Hospital — 10.
MR. PERCY FLEMMING — Royal London Ophthalmic Hospital — 10.
MR. J. H. FISHER — Royal London Ophthalmic Hospital — 10.

MR. C. D. MARSHALL — Royal London Ophthalmic Hospital — 10.

Wednesday, July 29th

MR. H. BARR GRIMSDALE and MR. G. T. BROOKS-BANK JAMES — St. George's Hospital — 1:30 to 4.
MR. W. T. LISTER — London Hospital — 3.
MR. PERCY FLEMMING — University College Hospital — 9.
MR. E. T. COLLINS — Charing Cross Hospital — 9 to 12.
MR. R. P. BROOKS — Prince of Wales General Hospital — 1:30 to 4:30.
MR. J. B. LAWFORD — Royal London Ophthalmic Hospital — 10.
MR. ARNOLD LAWSON — Royal London Ophthalmic Hospital — 10.
MR. J. H. PARSONS — Royal London Ophthalmic Hospital — 10.
MR. GEORGE COATS — Royal London Ophthalmic Hospital — 10.

Thursday, July 30th

MR. W. HOLMES SPICER — St. Bartholomew's Hospital — 3.
MR. H. L. EASON — Guy's Hospital — 2.
MR. A. B. ROXBURGH — London Hospital — 10.
MR. L. V. CARGILL — King's College Hospital — 2.
DR. H. W. LYLE — King's College Hospital.
MR. H. PERCY DUNN — West London Hospital — 2.
MR. TREACHER COLLINS — Royal London Ophthalmic Hospital — 10.
MR. C. A. WORTH — Royal London Ophthalmic Hospital — 10.
MR. M. L. HEPBURN — Royal London Ophthalmic Hospital — 10.
MR. A. C. HUDSON — Royal London Ophthalmic Hospital — 10.

Friday, July 31st

MR. A. W. ORMOND — Guy's Hospital — 2.
MR. HOLMES SPICER — Royal London Ophthalmic Hospital — 10.
MR. PERCY FLEMMING — Royal London Ophthalmic Hospital — 10.
MR. J. H. FISHER — Royal London Ophthalmic Hospital — 10.
MR. C. D. MARSHALL — Royal London Ophthalmic Hospital — 10.

Saturday, August 1st

MR. H. BARR GRIMSDALE and MR. G. T. BROOKS-BANK JAMES — St. George's Hospital — 9:15 to 11.
MR. HERBERT PARSONS — University College Hospital. — 9
MR. J. B. LAWFORD — Royal Ophthalmic Hospital — 10.
MR. ARNOLD LAWSON — Royal London Ophthalmic Hospital — 10.
MR. J. H. PARSONS — Royal London Ophthalmic Hospital — 10.
MR. GEORGE COATS—Royal London Ophthalmic Hospital—10.

Days and Hours to be Announced

MR. J. B. LAWFORD and MR. J. H. FISHER — St. Thomas' Hospital.
MR. ARNOLD LAWSON — Middlesex Hospital.
MR. L. J. PATON — St. Mary's Hospital.

OTOLOGICAL, LARYNGOLOGICAL, AND RHINOLOGICAL CLINICS

Monday, July 27th

MR. W. D. HARMER — St. Bartholomew's Hospital — 3:30.
MR. C. E. WEST — St. Bartholomew's Hospital — 3:30.
MR. W. G. HOWARTH — St. Thomas' Hospital — 9 to 12.
MR. HERBERT TILLY — University College Hospital — 2.
MR. WILLIAM HILL — St. Mary's — 9.
MR. ARTHUR CHEATLE — King's College Hospital — 2.
MR. WILLIAM HILL — St. Mary's Hospital — 2.
MR. GAY FRENCH — Royal Free Hospital — 9 to 12.
MR. R. S. COCKE — Royal Ear Hospital — 2.
MR. W. STUART-LOW — Central London Throat and Ear Hospital — 9 to 2:30.

Tuesday, July 28th

MR. J. A. ROSE — St. Bartholomew's Hospital — 1:45.
MR. W. M. MOLLISON — Guy's Hospital — 9.
MR. H. S. BARWELL — St. George's — 9:15 to 11.
SIR ST. CLAIR THOMSON — King's College Hospital — 2.
MR. E. B. WAGGETT and MR. E. D. DAVIS — Charing Cross Hospital — 9 to 12.
MR. H. D. GILLIES — Prince of Wales General Hospital — 9:30 to 12:30.
MR. JEFFERSON FAULDER — Hospital for Diseases of the Throat — 10.
MR. R. S. COCKE — Royal Ear Hospital — 2.
MR. H. A. KISCH — Royal Ear Hospital — 2.
DR. PETER H. ABERCROMBIE — Central London Throat and Ear Hospital — 9.
DR. ANDREW WYLIE — Central London Throat and Ear Hospital — 2:30.
MR. HAROLD KISCH — Central London Throat and Ear Hospital — 9.

Wednesday, July 29th

MR. W. D. HARMER — St. Bartholomew's Hospital — 1:45.
MR. C. E. WEST — St. Bartholomew's Hospital — 9.

MR. H. J. MARRIAGE — St. Thomas' Hospital — 9 to 12.
MR. T. B. LAYTON — Guy's Hospital — 9.
MR. J. A. EDMOND — Guy's Hospital — 9.
MR. H. S. BARWELL — St. George's Hospital — 2:15.
MR. SOMERVILLE HASTINGS — Middlesex Hospital — 1:30.
MR. SECCOMBE HETT — University College Hospital — 2.
MR. ARTHUR CHEATLE — King's College Hospital — 2.
MR. C. V. HOPE — King's College Hospital — 2.
MR. H. J. DAVIS — West London Hospital — 9.
MR. GEORGE BADGEROW — Hospital for Diseases of the Throat — 9.
MR. P. M. YEARSLEY — Royal Ear Hospital — 2.
MR. CHICHELE NOURSE — Central London Throat and Ear Hospital — 9.
DR. PETER ABERCROMBIE — Central London Throat and Ear Hospital — 2:30.
DR. DAN McKENZIE — Central London Throat and Ear Hospital — 9.

Thursday, July 30th

MR. SYDNEY SCOTT — St. Bartholomew's Hospital — 9.
MR. W. G. HOWARTH — St. Thomas' Hospital — 9 to 12.
MR. H. J. MARRIAGE — St. Thomas' Hospital — 2 to 5.
MR. P. R. W. de SANTI — Westminster Hospital — 2.
MR. HUNTER TOD — London Hospital — 2:30.
MR. SOMERVILLE HASTINGS — Middlesex Hospital — 9.
MR. C. J. GRAHAM — St. Mary's — 9.
SIR ST. CLAIR THOMSON — King's College Hospital — 2.
MR. ARTHUR CHEATLE—King's College Hospital—2.
MR. GEORGE WAUGH — Hospital for Sick Children — 3 to 5.
MR. CHARLES PARKER — Hospital for Diseases of the Throat — 2.
MR. FITZGERALD POWELL — Hospital for Diseases of the Throat — 10.
MR. RICHARD LAKE — Royal Ear Hospital — 2.
DR. ANDREW WYLIE — Central London Throat and Ear Hospital — 9.
DR. JAMES ATKINSON — Central London Throat and Ear Hospital — 2:30.
DR. DAN McKENZIE — Central London Throat and Ear Hospital — 2:30.

Friday, July 31st

MR. W. D. HARMER — St. Bartholomew's Hospital — 1:45.
MR. W. M. MOLLISON — Guy's Hospital — 9.
MR. HERBERT TILLY — University College Hospital — 2.
SIR ST. CLAIR THOMSON — King's College Hospital — 2.
MR. E. B. WAGGETT and MR. E. D. DAVIS — Charing Cross Hospital — 9 to 12.
MR J. W. BOND — Hospital for Diseases of the Throat — 10:15.
MR FRANK ROSE—Hospital for Diseases of Throat—2.
MR. P. M. YEARSLEY — Royal Ear Hospital — 2.
DR. E. A. PETERS — Royal Ear Hospital — 2.
MR. CHICHELE NOURSE — Central London Throat and Ear Hospital — 2:30.
DR. JAMES ATKINSON — Central London Throat and Ear Hospital — 9.

SPECIAL DEMONSTRATIONS

Monday, July 27th

DR. A. D. REID, DR. W. R. BRISTOW, and DR. CLAUDE GOULDESBROUGH — St. Thomas' Hospital — 9 to 12. X-ray and Electro-Therapeutics.
DR. W. S. FOX and DR. G. A. SIMMONS — St. George's Hospital — 2 to 4. X-ray and Electro-Therapeutics Department.
MR. W. E. MILES — Cancer Hospital — 4:30. Cancer of the Rectum.
DR. R. HUTCHISON — Hospital for Sick Children — 12 to 1. Infantile Scurvy.
MR. H. A. T. FAIRBANK — Hospital for Sick Children — 4 to 5. Subluxation of the Shoulder-Joint in Infants.
MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 2:30. Out-Patient Clinic.

Tuesday, July 28th

DR. A. D. REID, DR. W. R. BRISTOW, and DR. CLAUDE GOULDESBROUGH — St. Thomas' Hospital — 9 to 12. X-ray and Electro-Therapeutics.
MR. R. T. TIMBERG — St. Thomas' Hospital — 9 to 12. Physical Exercises.
DR. ROBERT KNOX — King's College Hospital — 2. Radiography.
DR. W. D'ESTS EMERY — King's College Hospital — 9. Pathological Laboratory.
MR. W. H. EVANS — Royal Free Hospital — 9 to 12. Surgical Cases.
MR. C. RYALL — Cancer Hospital — 4:30. Cancer of the Tongue and Mouth.
DR. A. F. VOELCKER — Hospital for Sick Children — 12 to 1. Abdominal Tuberculosis.
SIR VICTOR HORSLEY — National Hospital. Some Practical Points in Cranial Surgery.
MR. L. E. BARRINGTON-WARD — Hospital for Sick Children — 4 to 5. Cases of Hirschsprung's Disease Treated by Total Colectomy.
MR. GRAEME ANDERSON — St. Mark's Hospital—2:30.
MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 3 to 4. Special demonstrations.
MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 5. Out-Patient Clinic.

Wednesday, July 29th

DR. A. D. REID, DR. W. R. BRISTOW, and DR. CLAUDE GOULDESBROUGH — St. Thomas' Hospital — 9 to 12. X-ray and Electro-Therapeutics.

MR. S. G. SHATTOCK — St. Thomas' Hospital — 9 to 12. Pathological Laboratory.

SIR ARBUTHNOT LANE, and MR. C. H. FAGGE — Guy's Hospital — 2. Cases of Intestinal Stasis and Fractures.

MR. T. B. LAYTON—Guy's Hospital—2. Examination of cases by means of Killian's swinging laryngoscope. Tests of the vestibular nerve in cases of disease of the ear and brain. Cases of paralysis of the larynx and allied conditions.

MR. J. A. EDMOND — Guy's Hospital — 11:30. Cases of Syphilis of the nose and throat, treated by methods used in the British Army.

MR. JAMES BERRY — Royal Free Hospital — 9 to 12. Surgical Cases.

MR. GAY FRENCH — Royal Free Hospital — 10 to 12. Throat, Nose and Ear Cases.

MR. JOCELYN SWAN — Cancer Hospital — 4:30. Tumor of the Kidneys.

MR. O. L. ADDISON — Hospital for Sick Children — 4 to 5. Cases of Syphilitic Osteitis in Children.

MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 2:30. Out-Patient Clinic.

Thursday, July 30th

DR. R. S. TREVOR — St. George's Hospital — 2 to 4. Pathological Specimens in the Museum.

MR. J. CUNNING — Royal Free Hospital — 2 to 5. Surgical Cases.

MRS. VAUGHAN SAWYER — Royal Free Hospital — 10 to 12. Gynecological Cases.

MR. J. CUNNING — Cancer Hospital — 4:30. Cancer of the Breast.

DR. G. F. STILL — Hospital for Sick Children — 12 to 1. Congenital Pyloric Stenosis.

MEMBERS OF THE STAFF — Demonstrations in the Out-Patient Department — St. Peter's Hospital — 2.

MR. CUTHBERT WALLACE — St. Thomas' Hospital — 4. Demonstration of Prostatic Specimens.

MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 2:30. Out-Patient Clinic.

Friday, July 31st

DR. W. S. FOX and DR. G. A. SIMMONS — St. George's Hospital — 2 to 4. X-ray and Electro-Therapeutic Department.

DR. W. D'ESTS EMERY — King's College Hospital — 9. Pathological Laboratory.

MR. C. A. PANNETT — Royal Free Hospital — 2 to 5. Surgical Cases.

DR. E. U. WILLIAMS — Royal Free Hospital — 1 to 3. X-Ray Department.

DR. F. E. BATTEN — Hospital for Sick Children — 12 to 1. The Use of Celluloid Splints in the Treatment of Acute and Chronic Infantile Paralysis.

MR. GEORGE WAUGH — Hospital for Sick Children — 4 to 5. End-Results of Acute Osteomyelitis.

MR. L. E. C. NORBURY — St. Mark's Hospital — 2:30.

MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 3 to 4. Special demonstrations.

MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 5. Out-Patient Clinic.

Saturday, August 1st

DR. ROBERT KNOX — King's College Hospital — 2. Radiography.

DR. SILK and MR. F. F. BURGHARD, with the assistance of the architect and consulting engineer, will show visitors over the new building and explain the plans.— King's College Hospital — 2.

MRS. WILLEY — Royal Free Hospital — 9 to 12. Gynecological Cases.

MR. T. H. KELLOCK — Hospital for Sick Children — 9:30 to 11:30. End-Results of Operative Procedures.

MEMBERS OF THE STAFF — Central London Throat and Ear Hospital — 2:30. Out-Patient Clinic.

Days and Hours to be Announced

DR. GILBERT SCOTT — London Hospital — The X-ray in Treatment and Diagnosis.

DR. J. H. SEQUEIRA — London Hospital — Cases of Skin Disease of Surgical Interest.